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IN THIS ISSUE

KNOWLEDGE of specific deficiencies in the diets of population groups in various regions of the United States make it possible to direct nutrition programs to the correction of such deficiencies. The nature of dietary inadequacies has been determined both by food-habit studies and by surveys of blood levels for samples of populations. The report on "Biochemical Tests on the Blood of Native-Born and Reared Children in Two Regions" by Clara A. Storvick, Milicent L. Hathaway, and Ruth M. Nitchals is Part II of a survey on "Nutritional Status of Selected Population Groups in Oregon." For high school students in four counties, blood values were determined for vitamin A and carotene, for ascorbic acid, plasma protein, hemoglobin, and hematocrit. The values for serum vitamin A and for hemoglobin and hematocrit differed significantly for children in the four counties. The majority of the children had "good" or "excellent" blood levels for all constituents except carotene.

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The April, 1943 issue of the *Quarterly* contained an article "Are More Males Born in Wartime?" in which Dr. Constantine Panunzio reviewed the available literature on that question. In this issue, Dr. C. A. McMahan presents a paper "An Empirical Test of Three Hypotheses Concerning the Human Sex Ratio at Birth in the United States, 1915–1948." The three hypotheses subjected to test with national birth statistics are concerned with sex ratios at birth in relation to war, age of mother, and order of birth. The analyses are made for all births and for white and colored separately.

The spread of insurance plans providing for loss of earnings during periods of disability presents a need for statistics on disabling illness among employed persons. Detailed information on the duration of disability is required to give rates of disability within periods of time corresponding to those within limits of waiting and benefit periods common to disability benefits plans.

Data collected in a special morbidity study made in the Eastern Health District of Baltimore provide the required type of information for an employed group. The data are presented in the article "Duration of Disabling Acute Illness Among Employed Males and Females—Eastern Health District of Baltimore, 1938–1943" by Elizabeth H. Jackson.

Two conclusions are suggested relative to the effect of adoption of waiting and benefit periods on the rate of disabling days to be expected under insurance plans providing coverage for acute disabling illness among employed persons. First, imposition of a short waiting period, such as three, seven, or ten days, can be expected to result in a sharp decline in the rate. Second, limitation of the benefit period is likely to have little effect on the rate if the benefit period is more than three months in length.

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In recent years contraceptive services have been increasingly incorporated into maternal health programs of state and county health departments under the assumption that too-frequent childbirth may be detrimental to the health of mothers and children. Although much has been written about the effect of excess fertility on health, little is known about the extent to which health of wife, husband, and children underlie motivations of married couples regarding fertility planning and size of planned families. In this issue, Lee F. Herrera and Clyde V. Kiser present an article "Health of Wife, Husband, and Children in Relation to Fertility Planning and Fertility." This is the thirteenth of a series of articles based upon the Indianapolis Study and bearing the general title "Social and Psychological Factors Affecting Fertility."

NUTRITIONAL STATUS OF SELECTED POPULATION GROUPS IN OREGON

II. BIOCHEMICAL TESTS ON THE BLOOD OF NATIVE BORN AND REARED SCHOOL CHILDREN IN TWO REGIONS[1]

CLARA A. STORVICK, MILICENT L. HATHAWAY AND RUTH M. NITCHALS[2]

THIS paper is a report of the biochemical tests on the blood of selected population groups in the Coast and Central Regions, and presents the results of one of the phases of the Western Regional Research project on nutritional status of selected population groups in Oregon. The general plan of the entire project may be found in Part I (1) of this series of papers.

MATERIAL AND METHODS

The basis for the selection of the children examined has been described in Part I (1).

Five chemists, two in the field and three in the research laboratory at Oregon State College, devoted full-time to the analytical work in this study. Each chemist assumed full responsibility for one or more of the biochemical tests on the blood, *e.g.*, one chemist made all of the serum ascorbic acid analyses and another analyzed all of the serum samples for carotene and vitamin A.

Samples of blood from 766 non-fasting subjects were obtained by finger-puncture with a Bard-Parker blade. In order

[1] This study was a part of the Western Regional Research Project on Nutritional Status of Population Groups in Selected Areas of the State of Oregon with the cooperation of the Oregon Agricultural Experiment Station. It was financed in part from funds appropriated under the Research and Marketing Act of 1946. The cooperation and assistance of the Bureau of Human Nutrition and Home Economics, United States Department of Agriculture and the United States Public Health Service is acknowledged.

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to facilitate the work of the chemists, ten children reported at 9: 00 A.M., six at 10: 30 A.M. and the remaining eight at 1: 00 P.M. Such a schedule made it possible for the hemoglobin, hematocrit, and plasma protein determinations to be made on the samples from one group of children before the next group appeared. The other blood samples which were collected in 3 mm × 100 mm capillary tubes were sealed with Pyseal, centrifuged, packed in a Dewar flask containing dry ice and sent to the Nutrition Research Laboratory at Oregon State College where the following analyses were made on the serum: vitamin A, carotene, and ascorbic acid.

Analytical Procedures

Serum Vitamin A and Carotene. Vitamin A and carotene were determined on 85 mm^3 aliquots of serum according to the method of Bessey, Lowry, Brock, and Lopez (2). That "method depends on (1) saponification and extraction of the vitamin A and carotene from serum on a micro scale with solvents of low volatility; (2) measurement of the light absorption of small volumes at 328 and 460 mμ; (3) destruction of the vitamin A absorption at 328 mμ without affecting the absorption of other compounds at this wave length; and (4) remeasurement of the absorption at 328 mμ." Microgram per cent carotene = $(E_{460})(480)$. Microgram per cent vitamin A = (E_{328} before irradiation—E_{328} after irradiation)(637).

Serum Ascorbic Acid. The total ascorbic acid content was determined on 10 mm^3 aliquots of serum according to the Bessey, Lowry, and Brock (3) modification of the method of Lowry, Lopez, and Bessey (4) in which dinitrophenylhydrazine, which measures ascorbic acid after oxidation to dehydroascorbic acid, was used.

Hemoglobin. Hemoglobin was determined colorimetrically as alkaline hematin (Lowry) (5) with a Leitz Photoelectric Colorimeter which had been calibrated against the oxygen capacity method of Van Slyke and the alkaline hematin solutions read on the Beckman Spectrophotometer.

Hematocrit Value. The blood for hematocrit value determinations (Lowry) (5) was collected in 2 mm × 100 mm capillary tubes. A few crystals of Heparin sodium[3] in the tips of the tubes served as the anticoagulant. The ends of the tubes were sealed with Pyseal. The tubes were centrifuged at full speed in a clinical centrifuge for one hour. The length of the column of blood cells plus plasma as well as the length of the column of blood cells were recorded. Hematocrit values, *i.e.*, per cent of red blood cells was calculated as follows:

$$\frac{\text{Length of column of red blood cells}}{\text{Length of column of red blood cells + plasma}} (100) = \text{Hematocrit value.}$$

Plasma Protein. The plasma which was obtained in the estimation of hematocrit value was used for the determination of plasma protein. The Lowry and Hunter (6) gradient tube method for the determination of specific gravity was used. A linear density gradient was prepared in a graduated cylinder with mixtures of different proportions of kerosene and bromobenzene. Using potassium sulfate, six specific gravity standards, 1.0141, 1.0184, 1.0227, 1.0270, 1.0313, 1.0356, were prepared which correspond to plasma protein concentrations of 2.5, 4.0, 5.5, 7.0, 8.5 and 10 per cent, respectively. The protein concentration was read from a curve based on the position of the droplets of the standard specific gravity solutions.

Results and Discussion

Table 1 shows the number of biochemical tests performed in each of the four counties in Oregon, together with the mean values and ranges for each test according to the age and sex of the children studied. Not all determinations were available for all the children examined. The greatest number of determinations was made for hemoglobin (766) of which 425 were taken in the Coast Region consisting of Clatsop and Coos Counties and 341 in the Central Region which covered Desch-

[3] Obtained through the courtesy of Roche-Organon, Nutley, New Jersey.

County	Age	Sex	(1) Vitamin A			(2) Carotene			(3) Ascorbic	
			No. Cases	Mean Mcg Per Cent	Range Mcg Per Cent	No. Cases	Mean Mcg Per Cent	Range Mcg Per Cent	No. Cases	Mean Mg Per Cent
Clatsop	14	F	28	24	1–55	35	105	23–262	35	1.0
	14	M	30	30	12–84	36	107	48–219	37	0.9
	15	F	23	33	15–89	27	107	46–214	29	1.0
	15	M	21	27	8–93	21	100	40–193	23	0.6
	16	F	18	27	9–49	20	111	57–177	20	1.1
	16	M	28	37	20–94	30	100	38–207	32	0.7
Coos	14	F	46	32	6–68	46	109	55–205	47	1.0
	14	M	48	31	8–56	48	103	35–194	48	0.8
	15	F	33	32	10–52	33	114	40–189	34	1.0
	15	M	55	32	10–64	55	99	48–159	55	0.8
	16	F	33	38	13–61	33	126	75–214	33	0.9
	16	M	28	41	10–70	28	103	38–192	28	0.7
Deschutes	14	F	24	28	10–44	25	111	73–173	25	0.9
	14	M	11	34	21–53	11	135	84–187	11	0.9
	15	F	24	30	10–52	25	109	39–251	25	0.9
	15	M	10	39	25–68	10	109	55–155	10	0.9
	16	F	24	35	7–54	24	107	58–208	24	1.2
	16	M	16	37	19–56	16	108	65–174	16	0.9
Klamath	14	F	43	33	15–51	43	103	26–210	43	0.8
	14	M	37	35	18–63	39	102	38–195	40	0.7
	15	F	42	35	13–54	44	104	36–245	44	0.7
	15	M	36	37	10–61	37	96	50–277	38	0.8
	16	F	35	31	10–45	35	90	50–156	35	0.8
	16	M	30	45	25–61	30	107	49–212	30	0.8

Table 1. Results of biochemical tests on the blood, blood plasma and blood serum of 14, 15, and 16 year old children in four counties in Oregon.

utes and Klamath Counties. Fewest results were for vitamin A, 391 in the Coast Region and 332 in the Central Region, making a total of 723 determinations. The means should be considered in connection with the range of values as shown in the table, because the distributions covered wide ranges and were skewed in some groups.

In Table 2, mean values for blood constituents and the significance of differences between counties within regions, and between regions are presented. Several differences are highly significant statistically, especially in the Central Region, as indicated by the double asterisks in the table. However, as will

Acid	(4) Hemoglobin			(5) Hematocrit			(6) Plasma Protein		
Range Mg Per Cent	No. Cases	Mean Gm Per Cent	Range Gm Per Cent	No. Cases	Mean	Range	No. Cases	Mean Gm Per Cent	Range Gm Per Cent
0.2–2.0	35	13.7	11.6–15.1	32	41	33–57	32	7.0	6.0–8.0
0.2–1.7	37	14.4	12.1–16.1	35	42	32–54	35	7.1	6.0–7.7
0.2–1.7	30	13.7	11.7–15.0	29	41	30–48	30	7.2	6.4–7.9
0.1–1.5	23	14.6	13.1–16.4	20	44	38–49	21	7.0	6.1–7.5
0.5–1.8	21	13.5	11.4–15.1	20	40	34–47	21	7.1	6.1–7.9
0.2–1.7	32	15.0	13.2–16.9	31	45	39–58	31	7.2	6.4–8.5
0.2–2.0	48	13.0	10.2–14.9	45	40	34–47	47	7.0	6.4–8.5
0.1–2.1	48	13.9	11.9–16.0	44	42	37–49	44	6.9	6.3–7.7
0.2–2.2	34	13.2	11.4–14.8	32	41	34–50	33	7.0	5.5–8.1
0.2–1.9	56	14.5	11.8–16.8	53	44	32–50	52	7.0	5.8–8.0
0.2–1.9	33	13.5	11.8–15.0	33	41	33–47	33	7.1	6.4–8.0
0.2–1.7	28	14.5	11.9–17.6	24	45	36–53	26	7.1	6.5–8.0
0.2–1.6	25	13.5	8.2–14.7	24	41	30–47	25	6.9	6.0–7.3
0.2–1.8	11	14.7	13.0–16.1	11	45	37–53	11	6.9	6.1–7.5
0.2–1.9	25	13.7	11.9–15.8	23	42	37–48	25	7.2	6.7–8.2
0.2–1.6	10	15.3	14.5–16.5	9	47	43–54	9	6.9	6.1–7.3
0.2–2.3	24	13.7	12.4–14.9	24	41	37–49	24	7.2	6.7–7.9
0.1–1.5	16	15.2	13.7–17.8	16	46	39–51	16	7.2	6.7–8.2
0.0–1.6	43	14.0	10.5–15.5	40	44	33–49	42	7.0	6.2–7.7
0.0–1.5	40	14.6	12.7–16.8	40	45	38–53	40	6.8	5.9–7.7
0.1–1.5	44	14.1	12.7–15.6	44	43	33–51	44	7.1	6.4–7.9
0.2–1.8	38	14.9	12.9–16.9	37	45	26–55	37	6.9	6.1–8.3
0.2–1.7	35	14.0	12.7–16.0	34	43	39–49	35	7.0	6.3–7.9
0.2–2.2	30	15.9	13.5–19.6	29	49	43–56	29	7.0	6.2–7.6

be clarified in the following paragraphs, in a practical sense these differences are of little importance since they fall within the limits of specified levels of nutrition.

The biochemical data classified by the levels of blood constituents proposed by Bessey and Lowry (7), have been presented in Table 3 by counties, in Table 4 for boys and girls separately by region, and in Table 5 for boys and girls separately by age groups.

Serum vitamin A levels were highest in Klamath County of the Central Region and lowest in Clatsop County of the Coast Region (Table 3). Children in Coos County rated about equal to those in Deschutes County. Serum carotene values were lowest in Klamath County; highest in Coos County. Serum

ascorbic acid values were highest in Deschutes County, and lowest in Klamath County, both of the Central Region. Hemoglobin and hematocrit values were highest in Klamath and Deschutes Counties, both in the Central Region, and lowest in Coos County. In plasma protein, all counties ranked too high on the standards used to show county differences.

When the results were classified by sex in each region (Table 4), girls were higher in some biochemical tests, the boys higher in others. For serum vitamin A boys rated higher than girls in each region, but for serum carotene the girls rated about as good or better than the boys. For serum ascorbic acid values the girls far outranked the boys in each region, and the difference was highly significant statistically. For hemoglobin the boys of both regions rated slightly higher at the highest level. Hematocrit values were also higher among the boys in both

Table 2. Mean values for blood constituents and their statistical significance[1] for children studied in Oregon by region and county.

	Blood Constituent					
	Serum Vitamin A Mcg/100 Ml	Serum Carotene Mcg/100 Ml	Serum Ascorbic Acid Mcg/100 Ml	Hemoglobin Gm/100 Ml	Hematocrit Per Cent	Plasma Protein Gm/100 Ml
Coast Region						
Clatsop County	30	101	0.81	14.31	42	7.0
Coos County	34	110	0.88	13.78	42	7.0
Significance of Difference	*	—	—	**	—	—
Central Region						
Deschutes County	34	114	0.98	14.10	43	7.1
Klamath County	36	101	0.77	14.56	45	7.0
Significance of Difference	—	**	**	**	**	*
Region						
Coast	33	108	0.86	13.94	42	7.0
Central	35	105	0.83	14.41	44	7.0
Significance of Difference	*	—	—	**	**	—

* Significant at 5 per cent level.
** Significant at 1 per cent level.

Appreciation is expressed to Dr. J. C. R. Li, Associate Professor of Mathematics, Oregon State College, Corvallis, Oregon, who applied analysis of variance to the results.

regions. Plasma protein values showed no appreciable difference between the sexes.

When the biochemical data were classified by age groups of boys and girls in the four counties combined (Table 5), there was some relationship to age in most of the tests made. Serum vitamin A levels increased with age, but trends in serum carotene were less consistent. Serum ascorbic acid values tended to increase with age of girls, but trends were less consistent for boys. Both hemoglobin and hematocrit values were higher in older children. For hemoglobin, the increase in values with age was highly significant. For plasma protein, distributions were skewed but there appeared to be no relationship to age.

In order to determine possible relationship between pairs of biochemical tests, correlation coefficients were calculated and are presented in Table 6. Highly significant positive correlations were obtained for the following pairs of tests: serum vitamin A and serum carotene, serum vitamin A and serum ascorbic acid, serum vitamin A and hemoglobin, serum vitamin A and hematocrit value, serum carotene and serum ascorbic acid, and hemoglobin and hematocrit value.

Comments

Of the surveys on children which have been made, the one by Bessey and Lowry (7) on 1,200 New York State school children is most nearly comparable to the one reported in this paper. The results of the serum vitamin A determinations in the above-mentioned study in New York revealed that about 80 per cent of the children had values classified as "good." In the Oregon study, 54.1 per cent of the children had serum vitamin A values in that classification. Of the children of schools A, B, and C in the New York study about 50 per cent of them were classified as "fair" with respect to serum carotene. Likewise, in the Oregon study 50.5 per cent of the children were classified as "fair." The children in the New York study showed considerable variation in the concentration of ascorbic acid in the serum. Whereas, there were more Oregon children classified in the "excellent" group than in any of the other three groups, the

Blood Constituent	Level of Nutrition[1] Unit/100 Ml.	Clatsop County		Coos County	
		No. of Cases	Per Cent	No. of Cases	Per Cent
Serum Vitamin A Mcg./100 Ml.	Poor (Below 20)	31	20.9	38	15.6
	Fair (20–29)	55	37.2	47	19.3
	Good (30–49)	48	32.4	139	57.2
	Excellent (50 and Over)	14	9.5	19	7.8
Total		148	100.0	243	100.0
Serum Carotene Mcg./100 Ml.	Poor (Below 75)	38	22.5	47	19.3
	Fair (75–124)	86	50.9	122	50.2
	Good (125–199)	41	24.3	71	29.2
	Excellent (200 and Over)	4	2.4	3	1.2
Total		169	100.1	243	99.9
Serum Ascorbic Acid Mg./100 Ml.	Poor (Below 0.4)	31	17.6	37	15.1
	Fair (0.4–0.6)	40	22.7	64	26.1
	Good (0.7–1.0)	41	23.3	64	26.1
	Excellent (1.1 and Over)	64	36.4	80	32.7
Total		176	100.0	245	100.0
Hemoglobin Gm./100 Ml.	Poor[2]	0	0.0	4	1.6
	Fair[2]	27	15.2	79	32.0
	Good[2]	82	46.1	102	41.3
	Excellent[2]	69	38.8	62	25.1
Total		178	100.1	247	100.0
Hematocrit Value Per Cent	Poor (Below 33)	4	2.4	1	0.4
	Fair (33–39)	33	19.8	51	22.1
	Satisfactory (40 and Over)	130	77.8	179	77.5
Total		167	100.0	231	100.0
Plasma Protein Gm./100 Ml.	Poor (Below 6.0)	1	0.6	2	0.9
	Fair (6.0–6.4)	8	4.7	10	4.3
	Satisfactory (6.5 and Over)	161	94.7	223	94.9
Total		170	100.0	235	100.1

Table 3. Number and per cent of children in selected areas of Oregon having levels of nutrition indicated by biochemical tests on blood.

[1] Based on ratings of Bessey and Lowry (7).
[2] Since hemoglobin values vary with age and sex the following ratings were used:

(Continued on page 263)

Coastal Region		Deschutes County		Klamath County		Central Region		All Four Counties	
No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent
69	17.6	13	11.9	14	6.3	27	8.1	96	13.3
102	26.1	30	27.5	40	17.9	70	21.1	172	23.8
187	47.8	55	50.5	149	66.8	204	61.4	391	54.1
33	8.4	11	10.1	20	9.0	31	9.3	64	8.9
391	100.0	109	100.0	223	100.0	332	99.9	723	100.0
85	20.6	20	18.0	61	26.8	81	23.9	166	22.1
208	50.5	58	52.3	113	49.6	171	50.4	379	50.5
112	27.2	31	27.9	49	21.5	80	23.6	192	25.6
7	1.7	2	1.8	5	2.2	7	2.1	14	1.9
412	100.0	111	100.0	228	100.1	339	100.0	751	100.1
68	16.2	14	12.6	61	26.5	75	22.0	143	18.8
104	24.7	21	18.9	43	18.7	64	18.8	168	22.0
105	24.9	25	22.5	56	24.3	81	23.8	186	24.4
144	34.2	51	45.9	70	30.4	121	35.5	265	34.8
421	100.0	111	99.9	230	100.0	341	100.1	762	100.0
4	0.9	1	0.9	1	0.4	2	0.6	6	0.8
106	24.9	14	12.6	17	7.4	31	9.1	137	17.9
184	43.3	51	45.9	80	34.8	131	38.4	315	41.1
131	30.8	45	40.5	132	57.4	177	51.9	308	40.2
425	99.9	111	99.9	230	100.0	341	100.0	766	100.0
5	1.3	1	0.9	1	0.4	2	0.6	7	1.0
84	21.1	18	16.8	12	5.4	30	9.1	114	15.6
309	77.6	88	82.2	211	94.2	299	90.3	608	83.4
398	100.0	107	99.9	224	100.0	331	100.0	729	100.0
3	0.7	0	0.0	1	0.4	1	0.3	4	0.5
18	4.4	7	6.4	7	3.1	14	4.2	32	4.3
384	94.8	103	93.6	219	96.5	322	95.5	706	95.1
405	99.9	110	100.0	227	100.0	337	100.0	742	99.9

	Girls	*14 yr. Boys*	*15–16 yr. Boys*
Poor	Below 11.0	Below 11.5	Below 12.0
Fair	11.0–12.9	11.5–13.4	12.0–13.9
Good	13.0–13.9	13.5–14.4	14.0–14.9
Excellent	14.0 and over	14.5 and over	15.0 and over

Blood Constituent	Level of Nutrition[1] Unit/100 Ml.	Coastal Region			
		Boys		Girls	
		No. of Cases	Per Cent	No. of Cases	Per Cent
Serum Vitamin A Mcg./100 Ml.	Poor (Below 20)	30	14.3	39	21.5
	Fair (20–29)	59	28.1	43	23.8
	Good (30–49)	102	48.6	85	47.0
	Excellent (50 and Over)	19	9.0	14	7.7
Total		210	100.0	181	100.0
Serum Carotene Mcg./100 Ml.	Poor (Below 75)	52	23.9	33	17.0
	Fair (75–124)	113	51.8	95	49.0
	Good (125–199)	51	23.4	61	31.4
	Excellent (200 and Over)	2	0.9	5	2.6
Total		218	100.0	194	100.0
Serum Ascorbic Acid Mg./100 Ml.	Poor (Below 0.4)	50	22.4	18	9.1
	Fair (0.4–0.6)	66	29.6	38	19.2
	Good (0.7–1.0)	45	20.2	60	30.3
	Excellent (1.1 and Over)	62	27.8	82	41.4
Total		223	100.0	198	100.0
Hemoglobin Gm./100 Ml.	Poor[2]	3	1.3	1	0.5
	Fair[2]	54	24.1	52	25.9
	Good[2]	89	39.7	95	47.3
	Excellent[2]	78	34.8	53	26.4
Total		224	99.9	201	100.1
Hematocrit Value Per Cent	Poor (Below 33)	3	1.4	2	1.0
	Fair (33–39)	20	9.7	64	33.5
	Satisfactory (40 and Over)	184	88.9	125	65.4
Total		207	100.0	191	99.9
Plasma Protein Gm./100 Ml.	Poor (Below 6.0)	1	0.5	2	1.0
	Fair (6.0–6.4)	7	3.3	11	5.6
	Satisfactory (6.5 and Over)	201	96.2	183	93.4
Total		209	100.0	196	100.0

Table 4. Number and per cent of boys and girls in two regions of Oregon having levels of nutrition indicated by biochemical tests on blood.

[1] Based on ratings of Bessey and Lowry (7).
[2] Since hemoglobin values vary with age and sex the following ratings were used:

(Continued on page 265)

Central Region				Both Regions			
Boys		Girls		Boys		Girls	
No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent
6	4.3	21	10.9	36	10.3	60	16.1
23	16.4	47	24.5	82	23.4	90	24.1
88	62.9	116	60.4	190	54.3	201	53.9
23	16.4	8	4.2	42	12.0	22	5.9
140	100.0	192	100.0	350	100.0	373	100.0
30	21.0	51	26.0	82	22.7	84	21.5
75	52.4	96	49.0	188	52.1	191	49.0
36	25.2	44	22.4	87	24.1	105	26.9
2	1.4	5	2.6	4	1.1	10	2.6
143	100.0	196	100.0	361	100.0	390	100.0
40	27.6	35	17.9	90	24.5	53	13.5
28	19.3	36	18.4	94	25.5	74	18.8
26	17.9	55	28.1	71	19.3	115	29.2
51	35.2	70	35.7	113	30.7	152	38.6
145	100.0	196	100.1	368	100.0	394	100.1
0	0.0	2	1.0	3	0.8	3	0.8
14	9.7	17	8.7	68	18.4	69	17.4
48	33.1	83	42.3	137	37.1	178	44.8
83	57.2	94	48.0	161	43.6	147	37.0
145	100.0	196	100.0	369	99.9	397	100.0
1	0.7	1	0.5	4	1.1	3	0.8
6	4.2	24	12.7	26	7.4	88	23.2
135	95.1	164	86.8	319	91.4	289	76.1
142	100.0	189	100.0	349	99.9	380	100.1
1	0.7	0	0.0	2	0.6	2	0.5
6	4.2	8	4.1	13	3.7	19	4.9
135	95.1	187	95.9	336	95.7	370	94.6
142	100.0	195	100.0	351	100.0	391	100.0

	Girls	*14 yr. Boys*	*15–16 yr. Boys*
Poor	Below 11.0	Below 11.5	Below 12.0
Fair	11.0–12.9	11.5–13.4	12.0–13.9
Good	13.0–13.9	13.5–14.4	14.0–14.9
Excellent	14.0 and over	14.5 and over	15.0 and over

Blood Constituent	Level of Nutrition[1] Unit/100 Ml.	14 Year Old Boys		14 Year Old Girls	
		No. of Cases	Per Cent	No. of Cases	Per Cent
Serum Vitamin A Mcg./100 Ml.	Poor (Below 20)	17	13.5	28	19.9
	Fair (20–29)	36	28.6	40	28.4
	Good (30–49)	65	51.6	67	47.5
	Excellent (50 and Over)	8	6.3	6	4.3
Total		126	100.0	141	100.1
Serum Carotene Mcg./100 Ml.	Poor (Below 75)	27	20.1	27	18.1
	Fair (75–124)	71	53.0	82	55.0
	Good (125–199)	35	26.1	36	24.2
	Excellent (200 and Over)	1	0.7	4	2.7
Total		134	99.9	149	100.0
Serum Ascorbic Acid Mg./100 Ml.	Poor (Below 0.4)	33	24.3	21	14.0
	Fair (0.4–0.6)	32	23.5	25	16.7
	Good (0.7–1.0)	31	22.8	48	32.0
	Excellent (1.1 and Over)	40	29.4	56	37.3
Total		136	100.0	150	100.0
Hemoglobin Gm./100 Ml.	Poor[2]	0	0.0	3	2.0
	Fair[2]	27	19.9	28	18.5
	Good[2]	52	38.2	70	46.4
	Excellent[2]	57	41.9	50	33.1
Total		136	100.0	151	100.0
Hematocrit Value Per Cent	Poor (Below 33)	2	1.5	1	0.7
	Fair (33–39)	17	13.1	35	24.8
	Satisfactory (40 and Over)	111	85.4	105	74.5
Total		130	100.0	141	100.0
Plasma Protein Gm./100 Ml.	Poor (Below 6.0)	1	0.8	1	0.7
	Fair (6.0–6.4)	5	3.8	9	6.2
	Satisfactory (6.5 and Over)	124	95.4	136	93.2
Total		130	100.0	146	100.1

Table 5. Number and per cent of 14 through 16 year old boys and girls having levels of nutrition indicated by biochemical tests on blood.

[1] Based on ratings of Bessey and Lowry (7).
[2] Since hemoglobin values vary with age and sex the following ratings were used:

(Continued on page 267)

15 Year Old Boys		15 Year Old Girls		16 Year Old Boys		16 Year Old Girls	
No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent	No. of Cases	Per Cent
16	13.1	19	15.6	3	2.9	13	11.8
26	21.3	26	21.3	20	19.6	24	21.8
70	57.4	68	55.7	55	53.9	66	60.0
10	8.2	9	7.4	24	23.5	7	6.4
122	100.0	122	100.0	102	99.9	110	100.0
29	23.6	33	25.6	26	25.0	24	21.4
66	53.7	53	41.1	51	49.0	56	50.0
27	22.0	40	31.0	25	24.0	29	25.9
1	0.8	3	2.3	2	1.9	3	2.7
123	100.1	129	100.0	104	99.9	112	100.0
23	18.3	18	13.6	34	32.1	14	12.5
46	36.5	29	22.0	16	15.1	20	17.9
17	13.5	39	29.5	23	21.7	28	25.0
40	31.7	46	34.8	33	31.1	50	44.6
126	100.0	132	99.9	106	100.0	112	100.0
2	1.6	0	0.0	1	0.9	0	0.0
25	19.7	26	19.5	16	15.1	15	13.3
53	41.7	52	39.1	32	30.2	56	49.6
47	37.0	55	41.4	57	53.8	42	37.2
127	100.0	133	100.0	106	100.0	113	100.1
2	1.7	2	1.6	0	0.0	0	0.0
5	4.2	27	21.1	4	4.0	26	23.4
112	94.1	99	77.3	96	96.0	85	76.6
119	100.0	128	100.0	100	100.0	111	100.0
1	0.8	1	0.8	0	0.0	0	0.0
6	5.0	4	3.0	2	2.0	6	5.3
112	94.1	127	96.2	100	98.0	107	94.7
119	99.9	132	100.0	102	100.0	113	100.0

	Girls	*14 yr. Boys*	*15–16 yr. Boys*
Poor	Below 11.0	Below 11.5	Below 12.0
Fair	11.0–12.9	11.5–13.4	12.0–13.9
Good	13.0–13.9	13.5–14.4	14.0–14.9
Excellent	14.0 and over	14.5 and over	15.0 and over

peak in distribution was not as marked in serum ascorbic acid as it was in the case of some of the other nutrients. The results of the Oregon study were similar to those of the study on New York children in that values for hemoglobin for the boys increased with age. Furthermore, the mean values for hemoglobin for the boys were higher than those for the girls in the New York and Oregon studies. The results for the children of the two States were similar with respect to plasma or serum protein. From the uniformity of the results, it would appear that plasma or serum protein determinations are of questionable value in studies on nutritional status. Although plasma protein determinations were made in Oregon and serum protein was determined in the New York study, the results can be compared since, according to Van Slyke (8), the difference between serum and plasma protein values is not significant.

In a study on 436 children in five other counties in Oregon, Fincke (9) and her coworkers obtained values for hemoglobin which were similar to those reported in this paper. Their results also revealed that the values were higher for boys than for girls and that, for these particular age groups, the hemoglobin values for the boys increased with age but that those for the girls did not show an increase with age.

Table 6. Correlation coefficients[1] for pairs of biochemical tests based on 591[2] pairs of observations.

	Serum Carotene	Serum Ascorbic Acid	Hemoglobin	Hematocrit	Plasma Protein
Serum Vitamin A	+0.2334*	+0.1577*	+0.2107*	+0.1850*	+0.0527
Serum Carotene		+0.3916*	−0.0267	−0.0115	+0.0111
Serum Ascorbic Acid			−0.0704	−0.0381	−0.0078
Hemoglobin				+0.6688*	+0.0707
Hematocrit Value					+0.0200

[1] Significance levels for coefficient correlations with 591 pairs of observations: 0.08 at 5 per cent level; 0.11 at 1 per cent level.
[2] 591 is the number of children for whom data were obtained for all six blood constituents.
* Those which are statistically significant are significant at the 1 per cent level, or highly significant.

It was found that the mean hemoglobin values for Canadian boys and girls reported by Pett and Ogilvie (10) were lower than those obtained in the Oregon study for boys and girls of comparable age.

The hemoglobin levels of Parker High School children in South Carolina reported by Wilkins, Blakely, and Brunson (11), those of the children of Albemarle County, Virginia, reported by Englar, Blakely and Wilkins (12), and those of New York school children reported by Bessey and Lowry (7) are compared (Table 7) with the values obtained on the Oregon children included in this study. The data in this table show, in general, that the hemoglobin values for the New York and Oregon children were higher than those of the South Carolina and Virginia children. Also the relationship between age and hemoglobin in boys and the lack of relationship between age and hemoglobin in girls are illustrated.

Summary

This paper presents the results of determinations of serum vitamin A, serum carotene, serum ascorbic acid, hemoglobin, hematocrit value, and plasma protein for 14, 15, and 16 year old native born and reared school childern in two geographic regions (four counties) of Oregon. Blood samples were obtained by finger puncture from 766 children. The micromethods of Bessey and Lowry were used in making the above determinations.

The results were analyzed to determine whether or not there were any relationships between each of the biochemical tests and age and sex of the children as well as residence, in terms of County and Region.

The majority of the children had high values for all of the six blood constituents with the exception of serum carotene in which case about 50 per cent of the children were classified as "fair." There were, however, an appreciable number of the subjects who rated low for several of the blood tests.

By means of analysis of variance, regional differences were

	Boys							
	14		15		16		14	
	No. of Cases	Mean	No. of Cases	Mean	No. of Cases	Mean	No. of Cases	Mean
Albemarle County, Virginia	*	13.6	*	14.2	*	14.6	*	13.1
Parker High School, South Carolina	121	12.6	141	13.0	140	13.5	132	12.1
New York	116	14.3	127	14.6	73	14.5	159	13.5
Oregon	136	14.3	127	14.7	106	15.1	151	13.5

Table 7. Values for hemoglobin for children, classified by age and sex, for Parker High School,[1] Albemarle County,[1] New York[1] and Oregon.

[1] Values for hemoglobin for specific sex and age groups were read from graphs.

* The number of boys and girls included were not classified by age in the report, however, a total of 403 boys and 579 girls, from 9 through 17 years of age and above, were included in the study.

found in the values for serum vitamin A, hemoglobin, and hematocrit value; the values for those constituents for the Central Oregon children were higher than for the children living in the Coast Region. Regional differences were not found in the values for serum carotene, serum ascorbic acid, and plasma protein.

Intraregional differences and similarities were determined by analysis of variance. The values for serum vitamin A for the children of Coos County were higher than those for the Clatsop County children, whereas the Clatsop County children had the higher hemoglobin values. The children of the two counties did not differ significantly with respect to the results of the other four blood constituents. Statistical analysis of the results for Deschutes and Klamath Counties revealed that the children of Klamath County had higher values than the Deschutes County children for hemoglobin and hematocrit value, whereas the children of Deschutes County had the higher values for serum carotene, serum ascorbic acid, and plasma protein. The values for serum vitamin A for the children of the two counties did not differ significantly.

When age alone was considered, there was a relationship

Girls			
15		16	
No. of Cases	Mean	No. of Cases	Mean
*	13.2	*	12.9
168	12.1	127	12.3
155	13.5	77	13.4
133	13.7	113	13.7

between age and the values for serum vitamin A, hemoglobin, and hematocrit value.

The sex differences in hemoglobin were found to be highly significant statistically; the boys had the higher values.

For boys, the values for hemoglobin increased with age. The hemoglobin values for the girls did not show an increase with age but either decreased, remained about the same, or were inconsistent with age.

Comparable studies on 14, 15, and 16 year old children in New York, South Carolina, and Virginia showed that the mean hemoglobin values for the children of New York and Oregon were higher than those of the South Carolina and Virginia children.

Correlation coefficients were calculated to determine the relationship between pairs of biochemical tests. Statistically significant correlation coefficients were obtained for serum vitamin A and serum carotene, serum vitamin A and serum ascorbic acid, serum vitamin A and hemoglobin, serum vitamin A and hematocrit value, serum carotene and serum ascorbic acid, and hemoglobin and hematocrit value. The correlation coefficients for serum vitamin A and plasma protein, serum carotene and hemoglobin, serum carotene and hematocrit value, serum carotene and plasma protein, serum ascorbic acid and hemoglobin, serum ascorbic acid and hematocrit value, serum ascorbic acid and plasma protein, hemoglobin and plasma protein and for hematocrit value and plasma protein were not statistically significant.

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AN EMPIRICAL TEST OF THREE HYPOTHESES CONCERNING THE HUMAN SEX RATIO AT BIRTH IN THE UNITED STATES, 1915–1948

C. A. McMahan[1]

Introduction

THE balance between the sexes is an interesting and important characteristic of a population. The sex distribution is usually expressed by means of the sex ratio. It is not a ratio "in the strictest sense, but is actually the number of males per 100 females."[2] Many demographic phenomena are affected by the ratio of males to females, for example, the birth rate, the marriage rate, the amount and extent of migration, and the death rate. Even the social life of the community is tremendously affected by the sex distribution.[3]

It is well known among demographers that the human sex ratio at birth in the United States is in the neighborhood of 105.6 for the total population, 105.9 for whites, and 102.9 for Negroes. These data represent the mean sex ratio for the period 1915–1948, and were obtained from calculations in this study. In general the sex ratio at birth for the population of the United States is usually regarded as approximately 106 for whites and 103 for Negroes; for example, during the period 1939–1941[4], the sex ratio at birth among the white population of one state was 106.2 and for Negroes it was

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[2] Hagood, Margaret Jarman: Statistics for Sociologists. New York, Reynal and Hitchcock, Inc., 1941, p. 115.

[3] Smith, T. Lynn: Population Analysis. New York, McGraw-Hill Book Company, Inc., 1948, p. 113.

[4] Smith, T. Lynn: A Demographic Study of the American Negro. *Social Forces*, March, 1945, 23, pp. 379–387; and McMahan, C. A.: The People of Atlanta. Athens, Georgia, University of Georgia Press, 1950, p. 18.

103.0. Thus, the proportion of males is somewhat greater for whites than for the colored population. Although for mammals in general there is usually a greater proportion of males at birth, this is not always the case as many studies have shown.[5]

Concerning the human sex ratio at birth there have been many popular assertions; many of them have dealt with the idea that war causes a change in the ratio and the reasons for such a change. Among the assertions commonly made are the following: (1) The sex ratio among live births tends to rise during or after a war; (2) the sex ratio among live births tends to diminish as the age of the mother increases; (3) as the order of birth increases, the sex ratio among live births tends to fall; (4) the sex ratio increases in wartime because of the greater interval between births; (5) the sex ratio rises in wartime or immediately thereafter because *nature* compensates for war casualties (from battle as well as from starvation, etc.); (6) the sex ratio at birth rises in wartime because of undernourishment of women, and presumably undernourishment produces a greater proportion of males; (7) there is a tendency for the sex ratio of live births to increase as the socio-economic status of the mother rises; and (8) the emotional excitement of war produces an increase in masculinity.

[5] In most mammals the sex ratio at birth is near equality but generally there is a slight excess of males, *i.e.*, the sex ratio is above 100. Sydney A. Asdell, who has done a tremendous amount of work along this line and who is considered one of the leading authorities in the field, has summarized many studies. He found more than 50 per cent males in most studies of horses, goats, guinea pigs, rabbits, dogs, cattle, and in some studies of rats and mice; less than 50 per cent males were found in pigs, sheep, some goats and some rats. For an excellent discussion *see* Asdell, Sydney A.: PATTERNS OF MAMMALIAN REPRODUCTION. Ithaca, New York, Comstock Publishing Company, Inc., 1946, pp. 128, 152, 195, 259, 271, 298, 320, 364, 379, and 395.

For several studies of horses, mules, sheep, some chickens, and some studies of cattle and guinea pigs, Lush reported the sex ratio less than 100 at birth; he reported more than 100 for goats, swine, dogs, cats, rats, mice, rabbits, as well as some studies of guinea pigs and cattle. *See* Lush, Jay L.: ANIMAL BREEDING PLANS. Ames, Iowa, The Collegiate Press, Inc., 1945, pp. 405–409.

For examples of other studies, *see* Rice, Victor A.: BREEDING AND IMPROVEMENT OF FARM ANIMALS. New York, McGraw-Hill Book Company, Inc., 1942, p. 457; Crew, Francis A. E.: THE GENETICS OF SEXUALITY IN ANIMALS. Cambridge, The University Press, 1927; and Warren, Carl N.: ANIMAL SEX CONTROL. New York, Orange Judd Publishing Company, Inc., 1940, p. 85.

Since several of these assertions will be tested in this study, it is well to state the qualifications of a good hypothesis: It is stated in simple terms, it agrees with the observed facts, it does not conflict with laws ("natural") known to be true, and it permits the application of deductive reasoning.[6]

Assertions 1, 2, and 3. The first three of the eight assertions listed above seem to qualify as meeting the test of a good hypothesis and so will constitute the main body of this paper. They will be discussed as Hypotheses I, II, and III. The remaining five assertions will be discussed and disposed of immediately.

Assertion 4. Savorgnan maintains that masculinity in births increases in wartime on account of the greater intervals between births, which, in turn, provide greater rest for the female reproductive system and thereby brings about the birth of a larger proportion of males.[7]

Since empirical data on this subject are not available to the investigator, no test is made of this hypothesis.

Assertion 5. "There is a very widespread belief that *nature* compensates for the loss of males in war by producing a larger proportion of males in such periods than is usual in normal times."[8]

Such a statement, couched in psuedo-scientific language, cannot be tested empirically. However, the discussion under "Hypothesis I" indicates that war with its accompanying conditions does not directly affect the sex ratio at birth.

Assertion 6. The sex ratio at birth is higher among poorly nourished women than among well nourished women.

No test of this hypothesis is made in this study although

[6] Good, Carter V.; Barr, A. S.; and Scates, Douglas E.: THE METHODOLOGY OF EDUCATIONAL RESEARCH. New York, D. Appleton-Century Company, Inc., 1941, p. 195.

[7] Cited by Panunzio, Constantine: Are More Males Born in Wartime? The Milbank Memorial Fund *Quarterly*, July, 1943, 21, pp. 281–291.

[8] For an excellent discussion *see* Thompson, Warren S.: POPULATION PROBLEMS. New York, McGraw-Hill Book Company, Inc., 1942, pp. 48–49. One of the earliest references to the increase of boy babies in wartime was made nearly 200 years ago by the theologian Johann Sussmilch, who offered Divine intervention as the causal factor. Cited by Metropolitan Life Insurance Company: More Boy Babies in Post-War Years. *Statistical Bulletin*, April, 1939, 20, pp. 1–4.

there are many assertions elsewhere that the above is true.[9]

Assertion 7. There is a tendency for the sex ratio of live births to increase as the socio-economic status of the mother rises. Since it is well known that birth control is practiced to a greater degree in the upper classes, there is a possibility that this factor may affect the sex ratios in favor of males.

In one study of 5,466 completed families of a socially select group, it was found that the sex ratio at birth was significantly higher than that for the general population.[10] The investigator explained his findings by stating that social factors operated to produce a decrease of prenatal deaths. Since mortality is selective of males at all ages, this results in a higher sex ratio among live births.

Again in the present study, no attempt is made to test this hypothesis. However, in the discussion under "Hypothesis II" it will be seen that the data in Table C do not support this assertion.

Assertion 8. The emotional excitement of war produces an increase in masculinity at birth.

This conjecture is advanced by Huxley,[11] but since no data are available for testing it empirically, it will not be treated further.

Purpose of This Study

Although there has been much speculation and several excellent studies concerning the factors related to the sex ratio at birth, apparently there has not been a recent summary of the more significant findings. This is especially true in relation to studies making use of data appearing since the birth and death registration area of the United States was completed (1933). There is, in one place or another, much reference to the subject. This paper attempts to compile in convenient and concise form

[9] For discussions *see* Landis, Paul H.: Population Problems. New York, American Book Company, 1943, p. 369; also *see* the explanation by H. Ploss in Panunzio, *op. cit.*

[10] Winston, Sanford: Birth Control and Sex Ratio at Birth. *American Journal of Sociology*, September, 1932, 38, pp. 225–231.

[11] Cited by Panunzio, *op. cit.*, p. 288.

the results of the more significant studies and further, to supplement those studies by testing three of the hypotheses by means of data from the Census Bureau and the National Office of Vital Statistics.

Then it is the purpose of this study (1) to review some of the literature and to present in concise form a summary of representative studies pertaining to the human sex ratio at birth, more particularly among live births; (2) to analyze recent vital statistics in the United States in relation to "good" hypotheses suggested by a review of the literature; and (3) to present the results of the above empirical tests.

Scope and Data

This study is limited to the vital statistics of the birth-registration area of the United States for the period 1915–1948. Actually the period covered by most of the tables is of much shorter duration.

It will be recalled that the national birth-registration area was not established until 1915. At that time this area consisted of only ten states and the District of Columbia.[12] There was a gradual increase in the number of states included in the birth-registration area until 1933 when Texas entered as the last of the states to be included.[13] Accordingly the data used for this study are based on numbers of states varying from ten and the District of Columbia in 1915 to forty-eight states and the District of Columbia for the period 1933–1948.

That the registration of births is somewhat incomplete is generally accepted because, as late as 1946, it was estimated that 96.7 per cent of all white births and only 84.4 per cent of the nonwhite births were registered.[14] This is apparently a vast improvement over the early years of registration for it is a con-

[12] Vital Statistics of the United States: 1946, Part 1. Washington, Government Printing Office, 1948, pp. v-vii. It should be pointed out that the Federal Government has published vital statistics since 1850 with the exception of the period 1900–1914. For the most part these data were collected by enumeration during the decennial censuses but these particular types of data were inaccurate and incomplete.

[13] *Ibid.*, pp. vi-vii.

[14] *Ibid.*, pp. xi–xii.

siderable improvement over the 1940 findings when the percentages were 94.0 and 82.0 for whites and nonwhites respectively.[15]

As far as this study is concerned, this incompleteness of early data should have no effect upon the ratio of registrations of males and females. At least, the writer knows no reason why one sex should be registered in greater proportions than the other in this country.[16]

Since vital statistics data are supposedly records of complete registrations and no sampling situation exists *per se*, it is not deemed necessary in this study to deal with tests of significance, etc.[17]

The Three "Good" Hypotheses Analyzed

Hypothesis I. The sex ratio among live births does not tend to rise during or after a war. (Although this hypothesis is stated positively in most studies, the writer preferred the negative form which he believed accorded more closely "with the observed facts.")

1. *Review of Previous Studies.* By making use of the New York Census of 1865 and the United States Census of 1870, Simon Newcomb examined the data on the sex of over 100,000 children who must have been born about the close of the Civil War and concluded that not the slightest influence of the war could be noted on the ratio of males to females.[18] He confined much of his examination to the South, because he felt that greater suffering and privations probably would have influenced the distribution of the sexes most in that section.

One study finds that the proportion of male births following

[15] *Ibid.*, p. xii.

[16] In census (enumerated) data, a sex ratio lower than that known to exist at birth or which could be accounted for by differential mortality is found for Negro children under 5 years of age. *See* Smith: Population Analysis, p. 114. Whether this same error, whatever the error may be, is carried over into registration data is not known to this investigator.

[17] Hagood, *op. cit.*, pp. 612–616, has an excellent discussion of a subject closely related to this.

[18] Newcomb, Simon: A Statistical Inquiry into the Probability of Causes of the Production of Sex in Human Offspring. Washington, Carnegie Institute of Washington, 1944, p. 27.

a long war increases, and that this phenomenon has been repeatedly observed. The sex ratio in Germany around the First World War was used as an example.[19] There the sex ratio varied between 105.3 and 105.9 for the period 1910 to 1914; it rose gradually from 105.6 in 1914 to a high of 108.0 in 1919 and declined to 106.8 by 1923.[20] It was further pointed out that if the return of the soldiers caused an increase in the sex ratio, the rise to a point above normal should have been abrupt at the end of the war. Such was not the case; on the contrary, the increase continued during the war years while the soldiers were away from home.[21]

In comparing the sex ratio for the period 1906 to 1914 with that of 1914 to 1918 in twelve European countries, Panunzio quotes data which show that the sex ratio increased in ten of the twelve countries, remained the same in one, and declined two-tenths of one point in the other.[22] In this study to determine if masculinity decreased in the postwar period, that is, to make the case stand up for an increase during the war period, it was found that from a peak in 1919 the sex ratio fell to a low in 1926 in England; in 1929 in Belgium; in 1930 in France, Germany, Italy, and Scotland; and reached a low in Hungary in 1932.[23] These data support the thesis that war does increase the proportion of male births. However, Thompson, in a similar discussion of fifteen countries, some of which were neutral in World War I, states that "it cannot be said with any assurance that the sex ratio at birth is altered by war." To make the matter more controversial, Landis states that a greater proportion of males is born in postwar years, but concludes his discussion by stating that no explanation of this phenomenon is as yet adequate.[24]

In one recent work on the sex ratio in the United States dur-

[19] Metropolitan Life Insurance Company, *Statistical Bulletin*, April, 1939, 20, pp. 1–4.
[20] *Ibid.*, pp. 2–3.
[21] *Ibid.*, pp. 2–3.
[22] Panunzio, *op. cit.*, pp. 283–286.
[23] *Ibid.*, p. 286.
[24] Thompson, *op. cit.*, p. 49 and Landis, *op. cit.*, p. 269.

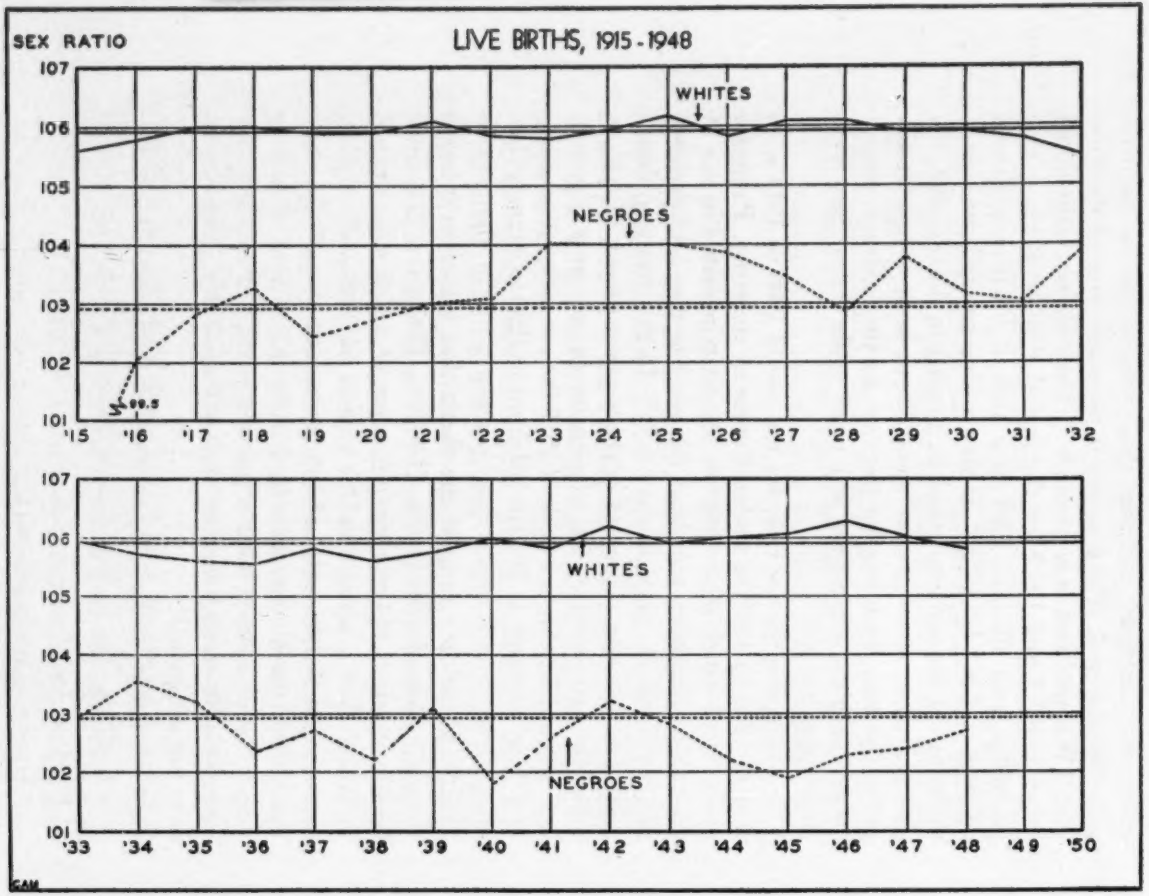


Fig. 1. Sex ratios among live births in the United States, by race, 1915–1948.

ing and after World War II, which utilizes some of the same data used in the present study, it was concluded that there is no significant increase in the sex ratio at birth during or immediately following a war.[25]

2. *Empirical Test.* In order to test this hypothesis empirically for the United States, Figure 1 was constructed. The straight solid line on the chart represents the mean sex ratio among whites for the entire thirty-four-year period from 1915 to 1948. In a similar manner the straight broken line represents the mean sex ratio among Negroes for the period 1915 to 1948. This chart indicates that among white live births the sex ratio was highest in 1921, 1925, 1927, 1928, and during the period 1942–1946, although the sex ratio in 1943 was not as high as it was in 1933. The lowest sex ratios occurred in 1915, 1932, and the period from 1934 to 1939. For Negroes, the highest ratio of males to females at birth occurred in 1923–1927, 1929, 1932, and 1934. The lowest sex ratio among Negro births occurred in 1915, 1916, 1919, 1936, 1938, 1940, and 1944–1946.

Since in some cases the chart indicates "above average" sex ratios for 1917–1918 and 1942–1945, it is of interest to compare the average sex ratio for the war years with the average sex ratio for all nonwar years. (The year 1941 has not been included as a war year since the sex ratio was definitely below average.) Table 1 indicates that for all classes and for whites the sex ratio for war years was slightly above the average of

Table 1. Average sex ratios of live births for war years as compared with nonwar years, 1917–1947.

Population	Nonwar Years[1]	War Years[1]
All Classes	105.6	105.7
Whites	105.9	106.0
Negroes	102.9	102.6

[1] War years include 1917–1918, 1942–1945 inclusive; nonwar years include 1919–1941 and 1946–1947, inclusive.

Source: Annual Volumes of Vital Statistics of the United States from 1917–1947.

[25] Metropolitan Life Insurance Company, *Statistical Bulletin*, June, 1949, 30, pp. 5–7.

the nonwar years (one-tenth of one point to be exact); but for Negroes the average for nonwar years was somewhat higher than the average for the war years. In view of the rather great fluctuations and racial differentials, the data do not seem to be conclusive.

Since it will be shown later in this paper that there is a slightly greater tendency for first-born children to be male than for later born children, it is of interest at this point to compare the proportion of first births among births occurring during the period 1934–1939 with the proportion during 1942–1946. In general the latter period had higher average marriage and birth rates than the period 1934–1939.[26] From Table 2 it will be noted that for the total population and for whites, there was a slightly greater proportion of first births during World War II and shortly thereafter; but for Negroes the proportion of first births decreased during this period. The sex ratios by race for the period 1934–1939 are compared with those of the period 1942–1946 in Table 3. These findings suggest support for the hypothesis that if the percentage of first births is increased as average marriage and fertility rates rise, the sex ratio is likely to increase. For whites the percentage of first births increased as well as the sex ratio; while for Negroes, there was a decrease in percentage of first births and a "resulting" decline in the sex ratio.

Table 2. Percentage of first births, 1934–1939, compared with 1942–1946.

Population	1934–1939	1942–1946
All Classes	34.9	37.1
White	35.7	38.3
Colored	29.4	28.0

Source: Annual Volumes of Vital Statistics of the United States from 1934–1939 and 1942–1946.

[26] Vital Statistics of the United States, 1947, Part I. Washington Government Printing Office, 1949, pp. xviii–xix; Metropolitan Life Insurance Company. Postwar Marriage Trends. *Statistical Bulletin*, 28, pp. 1–2; and Metropolitan Life Insurance Company, Marriages Continue to Decline. *Statistical Bulletin*, December, 1949, 30, pp. 4–6.

3. *Conclusion.* Based on the sex ratio, by race and for the registration area of the United States, the data support the hypothesis that the sex ratio at birth does not consistently change as a direct influence of war either during the war years or immediately thereafter.

Hypothesis II. The sex ratio among live births tends to diminish as the age of the mother increases.

1. *Review of Previous Studies.* Landis states that this hypothesis is sometimes used to account for the increase in the proportion of male babies in wartime; he further states that it sounds plausible since immediately after wars there is a rapid increase in marriage rates.[27]

In a study of the sex ratio among total confinements of white mothers, by age, during the period 1942–1946, it was shown that the proportion of male babies was somewhat higher among young mothers and the proportion decreased (although not consistently) with advance in age of the mother.[28] This study continues by stating that in the United States during World War II there was no rise in the proportion of births to young mothers; in fact, the proportion of such births was a trifle less than in the years immediately preceding the war.[29] This last statement possibly depends upon (1) the years considered prewar and war periods; (2) whether an allowance is made for changes in age distribution; and (3)

Table 3. Sex ratios of live births by race, 1934–1939, compared with 1942–1946.

Population	1934–1939	1942–1946
All Classes	105.3	105.7
White	105.7	106.1
Negroes	102.9	102.5

Source: Annual Volumes of Vital Statistics of the United States from 1934–1939 and 1942–1946.

[27] Landis, *op. cit.*, p. 269.

[28] Metropolitan Life Insurance Company, *Statistical Bulletin*, June, 1949, 30, pp. 5–7. These findings are based, in part, on some of the same data as those used in this study.

[29] *Ibid.*, p. 6.

whether births to the total population are considered as a unit or by race and nativity.

Table 4 verifies the fact that there was no rise in the proportion of births to young mothers for the war period. In constructing this table it was assumed that mothers under 25 years of age were "young mothers"; that 1937–1940 was the period immediately preceding World War II; and that 1941–1945 included war years. The table indicates that a greater percentage of births occurred to young mothers before the war than during the war. As a further check, Table 5 was constructed to determine the relative change in birth rates, by age of mother, for selected war years as compared with the average birth rates of a somewhat different prewar period (1935–1939). It is obvious that the birth rates, for whites and nonwhites, increased among most of the ages during the war years in comparison to the prewar period. Noteworthy is the fact that for native whites, there was a greater relative increase of births to mothers aged 25 and over for all war years except 1942. For nonwhites, however, there was a greater relative

Table 4. Percentage of total births (mother's age known) to women under 25 years of age, by race, 1937–1947.

Period	All Classes	White	Colored
1937	44.6	43.0	55.9
1938	44.7	43.2	56.0
1939	44.3	42.6	56.3
1940	44.2	42.5	56.6
1941	44.8	43.1	56.9
1942	45.4	43.8	57.2
1943	43.6	41.9	56.3
1944	42.0	40.3	54.2
1945	39.6	37.8	52.6
1946	42.0	40.5	53.3
1947	44.6	43.2	55.4
Average 1937–1940	44.5	42.8	56.2
Average 1941–1945	43.1	41.4	55.4

Source: Annual Volumes of Vital Statistics of the United States from 1937–1947.

increase of births to young mothers for 1942 and 1943; after 1943 the greater relative increase was among older women. Thus the assumption that a general rise in the sex ratio results at such times because males are more common among births to young mothers does not seem to follow from a study of the data.[30]

Table 5. Index numbers showing the relative importance of birth rates by age of mother, for native white and nonwhite women, 1942–1945. (Average 1935–1939 = 100).

Age of Mother	1942	1943	1944	1945
	NATIVE WHITE			
15–19	118	120	104	96
20–24	128	126	115	105
25–29	126	131	120	115
30–34	115	125	124	127
35–39	100	113	115	119
40–44	78	83	89	89
15–24	125	124	112	102
25–34	122	129	122	121
35–44	94	105	108	111
15–29	126	127	116	108
30–44	106	116	117	119
	NONWHITE			
15–19	120	123	114	114
20–24	116	120	118	113
25–29	108	114	118	119
30–34	109	114	117	116
35–39	102	112	118	123
40–44	91	95	95	91
15–24	118	121	116	113
25–34	108	114	118	118
35–44	99	108	111	114
15–29	115	119	117	115
30–44	104	111	114	115

Source: The above calculations are based on data found in Whelpton, P. K.: Forecasts of the Population of the United States, 1945–1975. Washington, Government Printing Office, 1947, p. 17.

[30] This supports the above article, *ibid.*, p. 6. Many of the above findings are somewhat in contrast to those in an earlier publication from the same source, Metropolitan Life Insurance Company: More Boy Babies in Postwar Years. *Statistical Bulletin*, April, 1939, 20, pp. 1–4.

2. *Empirical Test.* The sex ratios at birth of all classes of the population of the United States, by known age of mother, have been calculated from 1917 to 1947. An analysis of these results shows that there is not a consistent decline in the sex ratio at birth as the age of the mother increases, and for the most part no definite generalizations can be made from these data.

In order to analyze the data by race, similar calculations have been made for white and Negro live births for the same period (Tables A and B, Appendix).

Whites. For white live births, there is a consistent decrease in the mean sex ratio for the entire period 1917–1947, as the age of the mother increases. For individual years, however, there is no consistent decrease in the sex ratio as the age of the mother increases although there is a general trend in that direction.

Negroes. For Negroes the sex ratio for the total period is highest for the age group 15–19 and 20–24 and tends to fall as the age of the mother increases although there is no consistent decline. Again, as in the case of white mothers, there is no consistent trend by single years.

Stillbirths. In order to determine if the sex ratios among stillbirths could account for a change in the sex ratio of live births in relation to increase of the age of the mother, sex ratios of stillbirths among whites and Negroes, by known age of mother, for the period 1942–1947, have been calculated (Table C, Appendix). No consistent trend is discernible in the sex ratio of stillbirths either for whites or for Negroes.[31]

[31] It is generally known that for man mortality rates are higher for males than for females at all ages. This is true among males of many different species other than man. The interested reader should investigate Hamilton, J. B.: The Role of Testicular Secretions as Indicated by the Effects of Castration in Man and by Studies of Pathological Conditions and the Short Lifespan Associated with Maleness. RECENT PROGRESS IN HORMONE RESEARCH, PROCEEDINGS OF THE LAURENTIAN HORMONE CONFERENCE, Vol. 3. New York, Academic Press, Inc., 1948, p. 257. The sex ratio among all conceptions in man must run between 110 and 170. Furthermore Ciocco has found that the sex ratio among all stillbirths is about 133; the highest sex ratio is during the second month of uterogestation when it is about 433 (author's note: this may be based on too small a number of cases) and falls to 201 by the fourth month and to 135 by the ninth month. *See* Ciocco, A.: The Masculinity of Stillbirths and Abor-

(Continued on page 287)

Conclusion. Among both whites and Negroes there is a tendency for the sex ratio among live births to decrease as the age of the mother increases; however, there is no consistent trend. The consistency is greater among whites than among Negroes.

Hypothesis III. As order of birth increases, the sex ratio among live births tends to fall, i.e., the sex ratio among first born children is higher than among second born; the sex ratio is higher among tenth born than among twentieth born children, etc.

1. *Review of Previous Studies.* Winston, in a limited study of completed families, found that the chances of a male child's being born decreases from a ratio of about 117 for the first-born to around 105 for the fourth born.[32] Many studies mention the effect of order of birth on the sex ratio but few of them present substantiating evidence.

2. *Empirical test.* The sex ratios at birth, by order of birth, were calculated for the period 1942–1947 for whites and nonwhites (Tables D and E, Appendix). Although these data are for a relatively short period, some trends are indicated. For both whites and nonwhites, the sex ratio of the first-born child is higher than the average sex ratio of the second to the twenty-second child inclusive.[33] However, there is no consistent tendency, by single years or by averages, for the sex ratio to decrease as the order of birth increases.

3. *Conclusion.* The mean sex ratio of all children other than first-born is lower than the mean sex ratio of first-born chil-

tions in Relation to the Duration of Uterogestation and to the Stated Causes of Foetal Mortality. *Human Biology,* May, 1938, 10, p. 235.

In relation to mammals, most evidence indicates that there is a heavier foetal death rate for the male than for the female. *See* Winters, Laurence M.: ANIMAL BREEDING. New York, John Wiley and Sons, Inc., 1948, pp. 156–157; and Rice, *op. cit.,* pp. 443–444. Similar evidence is also presented by Asdell, *op. cit.,* and Warren, *op. cit.*

[32] Winston, Sanford: The Influence of Social Factors Upon the Sex Ratio at Birth. *American Journal of Sociology,* July, 1931, 37, pp. 1–21. Winston also discussed the relationship of war to the human sex ratio at birth.

[33] It must be realized that this hypothesis is in many ways a duplication of "Hypothesis II" because in general the age of the mother increases as birth order increases (that is, in the tabulations).

dren, thus indicating a slight tendency for first-born children to be male. The sex ratio does not consistently decrease, however, as the order of birth increases.

Conclusions

The following conclusions seem to result from this study: (1) There is much misinformation concerning the factors related to the sex ratio among humans at birth; (2) many of the assertions concerning the sex ratio at birth have not been empirically demonstrated; (3) this study has demonstrated empirically that the sex ratio in the United States was not appreciably or consistently influenced by the two World Wars; (4) it has also been shown empirically that, for both whites and Negroes, there is a tendency for the sex ratio among live births to decrease as the age of the mother increases; although this trend is not consistent, it is somewhat more so for whites than for Negroes; and (5) there is a slightly greater tendency for the first-born child to be a male than for later born children; and finally (6) the evidence seems to indicate that any increase in the sex ratio to above average during World War II can be considered primarily a result of the increase in the proportion of first births rather than a result of a greater proportion of births to young mothers.[34]

[34] Furthermore, there are studies which indicate that the median age of marriage has shown a slight decline for the first half of the twentieth century; yet there has been no corresponding increase in the sex ratio at birth for the last thirty years. *See* Ogburn, William F., and Nimkoff, Meyer F.: Sociology. New York, Houghton Mifflin Company, 1940, p. 481; Smith, T. Lynn: *op. cit.*, p. 151; and McMahan, C. A.: *op. cit.*, pp.. 97–103.

Appendix

Table A. Sex ratios of live births among whites, by known age of mother, 1917–1947.

Year	Sex Ratios by Age of Mother						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49
1917	106.6	105.7	106.3	106.3	106.2	105.5	103.4
1918	106.4	105.8	106.1	105.9	106.2	104.3	101.2
1919	105.2	105.6	106.5	106.2	104.8	106.2	105.4
1920	106.0	106.9	106.3	105.4	104.6	103.4	115.1
1921	106.3	106.2	106.0	106.2	105.7	105.9	102.3
1922	106.9	105.8	106.4	105.2	105.2	105.9	108.4
1923	106.1	105.7	106.1	105.3	106.3	105.1	101.1
1924	107.1	106.6	106.0	104.6	106.3	104.8	103.4
1925	107.1	106.8	106.6	105.5	105.2	104.1	107.1
1926	106.1	106.2	105.9	105.9	105.2	105.3	102.3
1927	105.5	106.3	106.9	106.1	105.1	104.5	100.8
1928	106.0	106.8	105.9	105.8	105.8	104.5	104.7
1929	106.4	106.2	105.8	105.8	105.4	105.3	100.9
1930	105.8	106.3	105.8	105.7	105.9	103.9	105.6
1931	105.6	106.2	105.8	105.6	105.4	104.5	104.3
1932	106.7	105.4	105.2	105.8	105.4	103.7	108.4
1933	106.7	106.6	105.7	105.4	105.0	105.1	107.2
1934	105.5	106.0	106.1	105.6	105.2	104.4	104.5
1935	105.5	106.0	105.7	105.8	104.7	104.8	103.7
1936	106.2	105.6	105.2	105.7	105.7	104.8	107.9
1937	106.5	106.0	105.4	105.8	106.0	104.3	102.8
1938	105.2	106.1	105.6	105.8	104.7	104.4	102.4
1939	106.2	105.8	105.8	106.1	104.5	104.9	103.9
1940	106.9	106.1	106.2	105.5	105.2	104.6	103.1
1941	106.3	105.9	105.8	105.0	106.0	105.4	105.1
1942	107.2	106.5	106.3	105.5	105.1	105.1	105.3
1943	106.4	106.0	106.5	105.3	104.4	103.8	105.0
1944	106.5	106.2	106.2	105.6	106.2	104.3	103.2
1945	106.4	106.5	106.3	105.3	105.9	105.0	101.3
1946	106.6	106.8	106.5	105.8	105.1	105.1	104.9
1947	106.2	106.2	105.8	105.7	105.7	105.0	108.1
Average 1917–1947	106.3	106.2	106.0	105.6	105.4	104.8	104.6

Source: Annual Volumes of Vital Statistics of the United States from 1917–1947.

Year	Sex Ratios by Age of Mother						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49
1917	102.3	102.4	102.0	102.1	105.5	98.1	106.5
1918	103.2	103.8	102.8	104.0	99.7	106.7	111.6
1919	101.1	101.9	100.8	103.5	106.7	103.4	110.5
1920	103.3	102.7	101.9	99.3	105.3	103.4	119.8
1921	102.8	104.3	102.0	102.5	105.9	99.0	106.9
1922	102.3	104.6	103.5	102.1	103.6	105.1	107.6
1923	101.2	105.8	103.6	105.5	104.5	102.2	103.5
1924	103.5	104.0	104.6	104.4	105.5	101.4	95.2
1925	103.6	105.2	104.8	103.9	105.0	103.0	100.3
1926	105.7	103.4	103.8	103.3	103.5	103.9	96.6
1927	103.4	103.1	105.2	104.1	101.4	102.1	102.9
1928	102.5	102.9	102.6	104.8	102.2	97.5	102.8
1929	104.0	104.7	103.7	102.1	104.2	99.9	97.6
1930	102.9	102.6	104.0	103.5	104.8	103.8	104.8
1931	103.3	103.8	103.6	102.2	102.5	102.3	95.1
1932	103.6	106.0	101.8	102.6	106.2	101.6	101.3
1933	104.6	102.9	102.6	104.3	102.8	102.8	102.9
1934	104.7	103.0	102.9	105.2	103.2	105.1	102.8
1935	102.1	103.0	103.3	105.9	102.1	101.4	97.0
1936	103.4	101.9	103.6	102.3	100.8	104.9	108.7
1937	102.6	103.0	102.2	104.1	101.9	101.9	96.7
1938	102.8	102.9	102.0	101.7	100.1	103.0	97.8
1939	102.9	103.4	103.4	103.2	103.3	94.0	109.5
1940	102.2	102.3	101.9	99.5	102.0	99.7	113.7
1941	101.5	103.1	102.1	103.5	102.4	104.8	98.5
1942	104.5	102.7	102.6	102.6	103.6	104.7	103.0
1943	103.8	101.9	103.7	102.8	102.4	101.5	92.1
1944	101.7	103.1	101.9	100.9	102.1	102.6	96.7
1945	102.4	102.0	102.1	102.8	98.9	102.6	91.8
1946	103.1	102.4	102.3	101.9	101.4	99.2	97.4
1947	101.6	103.5	102.3	102.7	100.6	101.4	108.8
Average 1917–1947	103.0	103.2	102.9	103.0	102.7	102.0	101.9

Source: Annual Volumes of Vital Statistics of the United States from 1917–1947.

Table B. Sex ratios of live births among Negroes, by known age of mother, 1917–1947.

Year	Age of Mother						
	15–19	20–24	25–29	30–34	35–39	40–44	45–49
	White						
1942	127.0	122.5	120.6	122.1	121.8	119.1	131.1
1943	121.6	120.5	120.2	124.3	123.6	128.7	114.1
1944	127.3	118.7	116.7	121.1	121.9	123.1	114.3
1945	124.7	115.4	121.9	115.6	122.4	122.7	110.5
1946	122.6	119.4	122.3	120.7	124.4	114.6	115.7
1947	124.1	120.7	120.4	117.2	125.0	116.3	116.7
Average 1942–1947	124.5	119.7	120.3	120.2	123.6	120.7	116.8
	Negro						
1942	134.2	131.5	131.3	136.3	135.3	157.7	134.6
1943	139.2	140.6	130.3	125.2	131.5	138.6	127.0
1944	134.5	130.1	127.8	133.7	121.0	117.3	114.3
1945	135.3	116.7	120.9	124.1	132.4	141.2	82.5
1946	125.9	123.2	121.5	120.2	122.4	123.4	115.4
1947	125.8	123.5	126.7	118.7	124.8	116.0	154.8
Average 1942–1947	132.6	127.5	126.4	126.0	127.6	131.3	119.7

Source: Annual Volumes of Vital Statistics of the United States from 1942–1947.

Table C. Sex ratios of stillbirths among whites and Negroes in the United States by known age of mother, 1942–1947.

Birth Order	Sex Ratios						
	6-Year Average	1947	1946	1945	1944	1943	1942
First	106.7	106.6	107.2	106.5	106.7	106.6	106.9
Second	106.1	105.6	106.3	106.5	105.9	106.2	106.1
Third	105.6	105.2	105.5	105.2	106.3	105.4	105.8
Fourth	105.5	105.3	105.6	106.0	105.6	105.3	105.2
Fifth	105.0	106.2	104.4	106.5	104.1	103.7	105.4
Sixth	104.6	105.1	104.9	102.3	105.2	105.1	105.1
Seventh	105.1	105.9	106.1	105.3	106.2	104.1	103.0
Eighth	104.1	104.5	103.9	105.6	103.7	102.0	104.9
Ninth	103.9	101.2	106.1	103.4	105.0	103.7	104.0
Tenth	105.3	106.1	105.8	105.8	102.8	103.5	108.1
Eleventh	103.9	104.1	104.6	104.8	103.5	107.6	99.2
Twelfth	103.8	104.2	99.3	103.7	105.2	101.6	108.8
Thirteenth	106.5	103.9	110.2	99.9	107.4	105.4	112.4
Fourteenth	107.3	106.0	105.1	104.0	109.2	115.1	104.5
Fifteenth	103.0	115.4	111.1	101.8	103.8	87.6	101.0
Sixteenth	112.4	136.0	105.2	116.7	120.2	105.7	96.2
Seventeenth	90.7	77.8	100.0	83.5	91.2	97.9	95.2
Eighteenth	99.0	120.0	75.5	94.9	106.8	109.5	96.2
Nineteenth	123.3	105.0	173.3	86.4	120.0	152.4	116.7
Twentieth	115.3	89.3	119.2	166.7	110.0	92.3	158.3
Twenty-first	96.0	—	—	116.7	166.7	58.3	125.0
Twenty-second	61.0	—	—	70.0	55.6	63.6	54.6
Average of Second to Twenty-Second Inclusive	105.6	105.4	105.8	105.8	105.7	105.5	105.7

Source: Annual Volumes of Vital Statistics of the United States from 1942–1947.

Table D. Sex ratios of live births among whites, by birth order, 1942–1947.

Birth Order	Sex Ratios						
	6-Year Average	1947	1946	1945	1944	1943	1942
First	103.0	102.7	102.8	102.8	102.9	103.3	103.7
Second	103.2	103.1	103.2	102.0	102.8	103.7	104.4
Third	102.5	103.1	102.9	103.0	102.2	102.1	101.6
Fourth	102.0	102.0	102.7	100.0	100.2	104.2	103.3
Fifth	101.2	101.5	100.0	102.0	100.9	100.7	102.1
Sixth	102.3	102.2	103.3	101.2	101.6	102.1	103.9
Seventh	101.9	100.7	101.5	102.2	99.5	105.6	102.4
Eighth	102.8	104.2	103.7	96.8	101.8	104.1	107.0
Ninth	100.9	101.2	101.6	102.9	104.6	95.0	99.7
Tenth	100.1	97.1	97.2	97.3	105.9	100.0	104.0
Eleventh	101.3	100.7	95.2	102.1	105.3	103.9	101.5
Twelfth	99.6	101.9	96.5	100.6	96.4	97.9	104.5
Thirteenth	101.0	99.6	110.7	102.9	100.4	98.3	93.4
Fourteenth	103.7	100.9	94.3	96.3	122.4	102.1	110.9
Fifteenth	106.0	103.3	105.7	102.3	113.0	92.0	124.5
Sixteenth	109.0	86.1	110.0	111.2	99.2	154.5	110.4
Seventeenth	111.1	94.5	89.9	112.0	129.9	144.4	115.6
Eighteenth	90.9	68.6	141.4	94.9	66.7	103.0	94.6
Nineteenth	109.7	121.1	87.0	105.6	95.0	153.3	110.5
Twentieth	95.4	93.1	77.1	85.7	125.0	140.0	100.0
Twenty-first	100.0	—	—	42.9	120.0	87.5	233.3
Twenty-second	65.7	—	—	50.0	75.0	100.0	42.9
Average of Second to Twenty-Second Inclusive	102.3	102.3	102.3	101.5	101.9	102.7	103.2

Source: Annual Volumes of Vital Statistics of the United States from 1942–1947.

Table E. Sex ratios of live births among nonwhites, by birth order, 1942–1947.

DURATION OF DISABLING ACUTE ILLNESS AMONG EMPLOYED MALES AND FEMALES—EASTERN HEALTH DISTRICT OF BALTIMORE, 1938–1943[1]

ELIZABETH H. JACKSON

THE dependence of many individuals on earnings from employment gives importance to the risk of interruptions of such earnings because of disabling illness. For many years commercial insurance companies and cooperative groups, such as mutual benefit associations, have provided protection for this risk to limited groups of individuals (25, 28). The governments of a number of countries have also established compulsory disability insurance programs (11, 22). Recently many individuals have proposed a federal compulsory disability insurance program for the United States. In the past decade, several states have adopted compulsory temporary disability benefit plans (1, 24).

Under disability insurance programs, protection is provided for temporary or permanent disability or both. The definition of disability and the period during which benefits are provided differ under separate plans. Temporary disability is often defined as inability to perform the usual occupation; permanent disability may be defined as inability to undertake work providing economic and social status reasonably similar to that to which the worker is accustomed (30). Temporary disability protection commonly begins after a short waiting period following the onset of each illness, such as three or seven days. It is often furnished for only a limited period, such as twenty-six or thirteen weeks. Permanent disability coverage begins at the end of the temporary disability benefit period and continues indefinitely (11, 12, 22, 24).

The growth of disability insurance plans presents a need for special statistics on the amount of disability in employed

[1] From the Milbank Memorial Fund. The study of illness in the Eastern Health District of Baltimore was conducted by the United States Public Health Service and the Milbank Memorial Fund.

groups. Data are required on both the incidence of illness and the rate of disabling days. Detailed information on the duration of individual illnesses is also needed as the basis for estimates of the effect of imposition of different waiting and benefit periods on the disability rates.

A limited body of the required type of data is available from records of disability benefit plans and from special morbidity studies (1, 6, 10–13, 16–19, 21, 23, 27). Data based on experience, under disability benefit plans, however, often suffer from the limitation that they are restricted to disability occurring within the period of time determined by specified waiting and benefit periods. Data obtained in morbidity studies overcome this difficulty if the complete duration of disability is shown.

The purpose of the present paper is to provide information on the duration of disabling *acute* illness in a sample of employed persons observed in a special morbidity study made in the Eastern Health District of Baltimore from 1938 to 1943. The data are presented in such a way that rates of disabling illness and disabling days occurring within different specified periods following the onset of disability can be determined. Emphasis is placed on disability occurring within the limits of waiting and benefit periods considered for disability insurance plans. Data are given separately according to the sex and age of the individual and the diagnosis of illness.

Data presented in this paper must be interpreted with caution. They cannot be taken to indicate specifically the disability rates to be expected for other population groups, especially with the adoption of disability insurance. Disability rates differ with a number of factors, such as the nature of the employment, the passage of time, and the existence (or absence) of disability insurance (13, 14, 15, 23). The data can be used, however, to give a general indication of disabling illness in an employed, urban population.

The Sample Population

The study in the Eastern Health District was conducted

from June, 1938, to May, 1943, in a sample of white families observed for two or more months in thirty-four city blocks. Seventeen of the blocks were included in the study for the entire five years; the other seventeen blocks were surveyed for only three years.

All white families that lived in houses in the surveyed blocks and were willing to cooperate in the study were included in the sample population. No effort was made to continue visiting families when they moved out of the surveyed blocks. White families that moved into the vacant houses were added to the study, however.

The district was characterized by considerable population movement. Approximately two-thirds of the 1,270 families observed in the seventeen blocks followed for five years moved into or out of the surveyed area during the five-year period (8).

The sample population of the Eastern Health District was similar to the white population of Baltimore in sex and age composition. The families lived under moderate economic circumstances, considered representative of the white wage-earning population of the City. During the middle study year the majority of the reported family incomes were between $1,000 and $2,500. The estimated mean value of owned homes was $2,790 and the mean rental of rented homes was $23 a month (5).

As was to be expected, more males than females were employed. During the middle study year, 87 per cent of the males and 33 per cent of the females 15 years of age or older were in the labor force. The labor force included individuals in three employment status groups. Ninety-two per cent of the males and 81 per cent of the females were employed full time, i.e., three days or more per week. Three per cent of the males and 8 per cent of the females were engaged in part-time employment, defined as employed two days or less per week. Five per cent of the males and 11 per cent of the females were "seeking work" or on work relief (5).

Most of the employed persons 15 years of age or older were

Occupation Group	Males	Females
All Occupations, Except Farm	100.0	100.0
Dealers, Managerial, Professional, Except Farmers	11.0	8.0
Clerks, Salesmen	15.4	32.6
Skilled Craftsmen, Foremen	24.7	3.5
Operatives, Semiskilled Workers	32.5	34.9
Domestic Workers	—	4.5
Service and Protective Workers	7.5	16.4
Laborers, Except Farm	8.9	0.1
Number with Known Occupation	2,009	749

Table 1. Distribution of employed males and females 15 years of age and older among different broad occupation groups.[1] Eastern Health District of Baltimore, 1940–1941.

[1] Excluding persons with unknown occupation.
Taken from: Collins, Selwyn D.; Phillips, F. Ruth; and Oliver, Dorothy S.: Specific Causes of Illness Found in Monthly Canvasses of Families. Sample of the Eastern Health District of Baltimore, 1938–1943. *Public Health Reports*, September 29, 1950, 65, No. 39, p. 1242.

engaged in clerical-sales, skilled and semiskilled occupations (Table 1). In the middle study year one-third of the males were engaged as operatives or semiskilled workers and an additional one-fourth as skilled craftsmen or foremen. One-third of the females were employed as operatives or semiskilled workers, and another third as clerks and saleswomen.

The sample population for the present study was limited to individuals 16–64 years of age who were in the labor force. The population included 9,140 person-years of observation—6,515 male and 2,625 female (Table 2). Slightly less than half of the

Table 2. Age distribution of employed males and females. Eastern Health District of Baltimore, 1938–1943.

Age Group	Per Cent		Number	
	Male	Female	Male	Female
Ages 16–64	100.0	100.0	6,515	2,625
16–34	47.7	63.1	3,110	1,656
35–54	42.2	30.6	2,747	804
55–64	10.1	6.3	658	165

males were in the 16–34 year age group but almost two-thirds of the females were in that age group. The age distribution of the employed males and females was similar to the age distribution of employed white males and females in Baltimore and in urban areas in the United States in 1940 (32).

Nature of the Illness Data

Data on illness were obtained in monthly interviews with a responsible person in each household (usually the housewife). During the first interview, information was obtained about all illness present on the day of the visit. At subsequent interviews, records were made of all illness which had occurred since the preceding visit.

No specific definition of illness was adopted for use in the study. In studies of illness conducted by the periodic canvass of families, the term has been understood to include any affection or disturbance of health persisting for a considerable part of one or more days. An illness was considered disabling when it caused inability to pursue usual activities, such as working, attending school, or performing housework.

Information on the cause of disability was obtained in the interviews with the family informant. Medical confirmation or correction of the family diagnosis was obtained for illnesses attended by a physician (including hospital or clinic cases).

Data for the present analysis were limited to acute disabling illnesses. The diagnosis of the illness was classified on the basis of the sole or primary cause. Four broad diagnosis groups were used for the present paper:

1. Respiratory diseases (including tonsillitis).
2. Digestive diseases (including appendicitis).
3. Nonoccupational accidents.
4. Other acute illness, such as diseases of the skin, teeth and gums, ear, and vision; asthma and hayfever; and female genital and puerperal diagnoses.

Data on disability due to occupational accidents and pregnancies were excluded from the general analysis and presented

in appendices (Tables 5–8). Occupational accidents were omitted because coverage for them has been provided under Workmen's Compensation laws and often excluded under disability insurance plans. Pregnancies were omitted because they represent a different type of disability risk, which has often been excluded from disability benefit plans, and in some countries covered under a special social security program.

Incidence of Disabling Illness and Disabling Days

Cases of illness presented in this study represent an incidence or occurrence of sickness over an average twelve-month period. All disabling days occurring within the period of observation are included.

During the study, 2,683 disabling acute illnesses (including nonoccupational accidents) occurred in the employed population—1,616 among males and 1,067 among females. These illnesses caused 17,192 disabling days among males and 11,233 disabling days among females.

Table 3. Annual rate of disabling acute illness and nonoccupational accidents and days of disability due to such conditions, among employed males and females of different ages. Eastern Health District of Baltimore, 1938–1943.

Age Group	Rate Per 1,000 Population		Number	
	Male	Female	Male	Female
	DISABLING ILLNESS			
Ages 16–64	248.0	406.5	1,616	1,067
16–34	265.6	406.4	826	673
35–54	223.9	390.5	615	314
55–64	266.0	484.8	175	80
	DAYS OF DISABILITY			
Ages 16–64	2,638.8	4,279.2	17,192	11,233
16–34	2,532.2	3,997.0	7,875	6,619
35–54	2,466.7	4,507.5	6,776	3,624
55–64	3,861.7	6,000.0	2,541	990

The rate of disability was considerably higher among females than among males (Table 3). The average annual number of illnesses was 248 per 1,000 males and 407 per 1,000 females. Approximately three days of disability occurred per male and four per female each year.

Disability rates differed somewhat with age (Table 3). Among males the rate of illness declined and the rate of disabling days showed little change from ages 16–34 to 35–54. In comparison, the rate of illness showed little change and the rate of disabling days increased among females in corresponding age groups. From ages 35–54 to 55–64, the rate of illness increased approximately 20 per cent for each sex. The rate of disabling days rose approximately 60 per cent among males and 30 per cent among females.

Illness rates by diagnosis (Table 4) showed that respiratory diseases were the chief cause of disability. Respiratory disease

Table 4. Annual rate of disabling acute illness and days of disability due to such illness, classified by diagnosis, among employed males and females. Eastern Health District of Baltimore, 1938–1943.

Diagnosis Group	Rate Per 1,000 Population		Number	
	Male	Female	Male	Female
	DISABLING ILLNESS			
All Diagnoses	248.0	406.5	1,616	1,067
Respiratory Diseases	148.6	217.5	968	571
Digestive Diseases	22.2	36.2	145	95
Nonoccupational Accidents	18.7	35.4	122	93
All Other Illness	58.5	117.4	381	308
	DAYS OF DISABILITY			
All Diagnoses	2,638.8	4,279.2	17,192	11,233
Respiratory Diseases	1,118.3	1,760.0	7,286	4,620
Digestive Diseases	222.7	445.0	1,451	1,168
Nonoccupational Accidents	354.4	735.2	2,309	1,930
All Other Illness	943.4	1,339.0	6,146	3,515

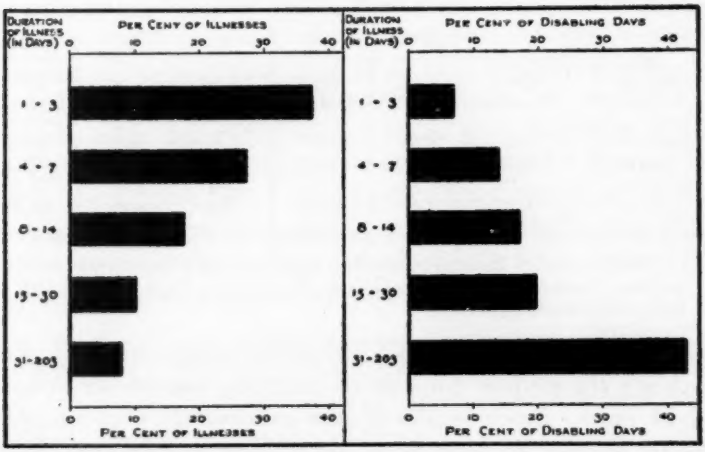


Fig. 1. Distribution of disabling acute illnesses and nonoccupational accidents and days of disability due to such conditions according to the duration of the disabling illness. Employed persons, Eastern Health District of Baltimore, 1938–1943.

accounted for 50–60 per cent of the disabling illnesses and approximately 40 per cent of the disabling days for each sex. Digestive diseases contributed approximately 10 per cent and nonoccupational accidents roughly 15 per cent of the disabling days. A number of additional diagnoses grouped together as "all other illness" contributed small proportions of total illnesses and disabling days.

Most of the illnesses caused only short periods of disability. The small proportion of illnesses with long duration of disability contributed, however, a large percentage of the disabling days (Figure 1). Thus, approximately two-thirds of the illnesses caused only a week or less of disability and accounted for about 20 per cent of the disabling days. Approximately one-fourth of the illnesses, with disability of from eight to thirty days, contributed slightly more than a third of the disabling days. Only 8 per cent of the illnesses had more than a month of disability, but such illnesses were responsible for slightly more than 40 per cent of the disabling days.

The median duration of disability was five days (Table 5).

Age Group	Male			Female		
	Lower Quartile	Median	Upper Quartile	Lower Quartile	Median	Upper Quartile
Ages 16–64	2.61	5.19	10.67	2.13	4.91	10.36
16–34	2.38	4.69	9.10	1.89	4.47	9.82
35–54	2.79	5.31	11.11	2.65	5.90	11.25
55–64	3.23	6.85	14.71	2.23	4.64	12.50

Table 5. Median duration of disabling acute illnesses and nonoccupational accidents. Employed males and females of different ages, Eastern Health District of Baltimore, 1938–1943.

It was similar for each sex but differed somewhat with age. For each sex the median duration of disability was lowest at ages 16–34 years. Among males it rose consistently with age, but among females an increase at ages 35–54 was followed by a decline for ages 55–64.

The median duration of disability differed considerably for the four diagnosis groups of illness (Table 6). It was shortest for digestive diseases and longest for nonoccupational accidents. It was three days for the former diagnosis group and eight days for the latter diagnosis group for each sex. The median duration of disability was five days for respiratory diseases for each sex. It was seven days among males and only four days among females for the "all other illness" group. The relatively short duration of the "all other illness" group among

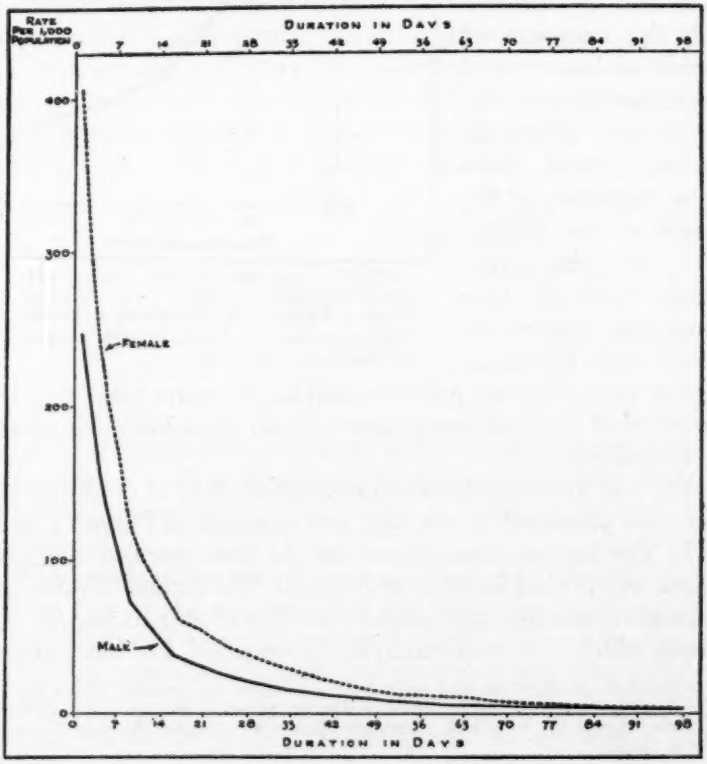
Table 6. Median duration of disabling acute illnesses classified by diagnosis. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

Diagnosis Group	Male			Female		
	Lower Quartile	Median	Upper Quartile	Lower Quartile	Median	Upper Quartile
All Diagnoses	2.61	5.19	10.67	2.13	4.91	10.36
Respiratory Diseases	2.64	4.82	8.24	2.64	5.28	9.04
Digestive Diseases	1.79	3.48	10.25	1.49	3.19	15.75
Nonoccupational Accidents	2.96	7.72	22.33	3.82	8.14	24.88
All Other Illness	2.80	7.28	17.08	1.41	3.88	11.00

females was due in part to the short duration of female genital and puerperal diagnoses, which accounted for approximately one-fifth of the disabling illnesses in this diagnosis group.

As a result of the short duration of disability, exclusion of sickness occurring within short periods after the onset of disability (as done with insurance waiting periods) sharply reduces the sickness rate. On the other hand, exclusion of sickness occurring after three to six months of disability (the effect of the insurance limitation on the benefit period) causes little change in the rate of disabling days.

Fig. 2. Annual rate of acute illness and nonoccupational accidents with specified days of disability or more among employed males and females. Eastern Health District of Baltimore, 1938–1943.



Disabling Illness in Specified Periods After Onset

Rates of disability are presented in a series of Figures (2, 4–8, 10, and 11)[2] in such a way that disabling illness and disabling days occurring within specified periods after the onset of disability can be determined. The statistical methods for showing rates of cases of illness and days of disability differ. For, rates of cases can be affected only by exclusion of illness of less than a particular duration because no illness is counted more than once, regardless of the length of the disability. On the other hand, rates of disabling days can be affected both by exclusion of days occurring prior to a certain day after onset and by omission of days occurring after certain days following onset of disability.[3]

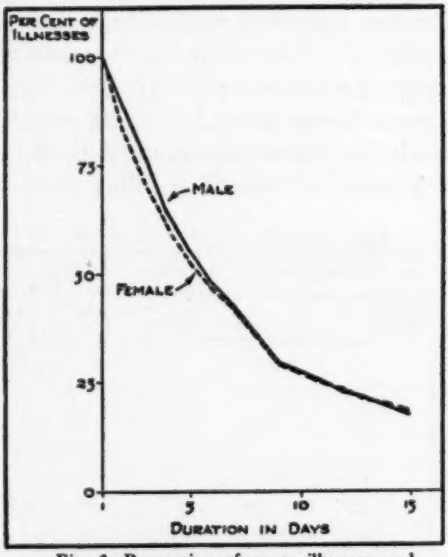


Fig. 3. Proportion of acute illnesses and nonoccupational accidents with specified days of disability or more among employed males and females. Eastern Health District of Baltimore, 1938–1943.

Rates of disabling illness with specified days of disability or *more* are presented by sex, age, and diagnosis in Figures 2 and 4–7. The highest rates, shown for the first specified day are based on the total number of illnesses. The decline in rates on successive specified days shows the effect of eliminating all illnesses which have terminated by the specified day but includ-

[2] Numbers on which the rates are based are presented in Appendix Tables 1–4.

[3] Statistical methods used in the analysis in this paper are the same as those used by Dorn, Harold F.; Falk, I. S.; Fitzhugh, Gilbert W.; Gafafer, William, M.; and Keffer, Ralph.

ing all illnesses which lasted for the specific number of days indicated, *or any greater number of days.*

Rates for any specified days are, of course, comparable in nature to ones obtained under insurance plans requiring a waiting period through the preceding day. For example, the rates for the fourth specified day correspond to rates under an insurance plan with a three-day waiting period. The rates for the eighth day are similar in nature to ones under an insurance plan with a seven-day waiting period, and so on.

The rate of disabling illness dropped sharply for each sex with successive elimination of sicknesses causing from 1 to 10 days of disability. It declined somewhat more slowly with exclusion of illnesses causing from 11 to 15 days of disability, and then gradually with elimination of illnesses causing longer duration of disability (Figure 2). Specifically, the rate of 248 disabling illnesses per 1,000 males and 407 disabling illnesses per 1,000 females declined as follows when limited to illnesses of only 4, 8, 11, or 15 days or more of disability:

Duration in Days	*Rate Per 1,000 Population*	
	Male	*Female*
4 or more	158	247
8 " "	88	143
11 " "	63	100
15 " "	43	74

Expressed proportionately, about a third of the illnesses caused more than a week of disability and approximately one-fifth of them caused more than two weeks of disability for each sex (Figure 3).

The female illness rate in each age group was above the male illness rate in the corresponding age group for most specified days (Figures 4 and 5; Appendix Table 9). The excess among females compared with males was generally of similar relative magnitude for different specified days for the 16–34 year age group and for the 35–54 year age group. At ages 55–64, how-

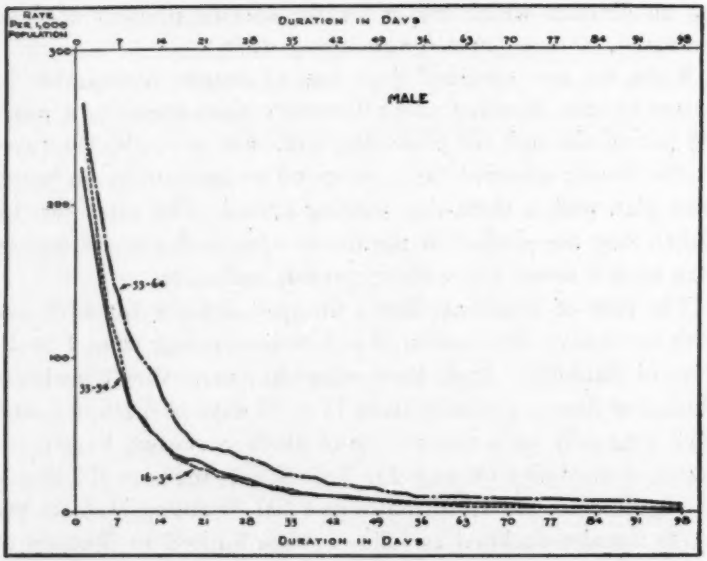


Fig. 4. Annual rate of acute illness and nonoccupational accidents with specified days of disability or more among employed males of different ages, Eastern Health District of Baltimore, 1938–1943.

ever, the excess in the illness rate among females compared with males was of smaller relative magnitude when illnesses causing specified short periods of disability (especially one to three days) were excluded than for illness of all durations.

The rate of illness causing specified days of disability or more differed with age (Figures 4 and 5; Appendix Table 9). Among males the rate at ages 16–34 was somewhat higher than the rate at ages 35–54 for specified durations up through one week, but was similar to the rate at ages 35–54 for specified durations longer than one week. Among females the rate of illness at ages 35–54 was generally above the rate at ages 16–34, especially for specified durations over six weeks. For each sex the rate at ages 55–64 was higher than the rate for either of the two younger age groups for nearly all of the specified days.

The disabling illness rate for each diagnosis group declined sharply with successive exclusion of sicknesses causing short

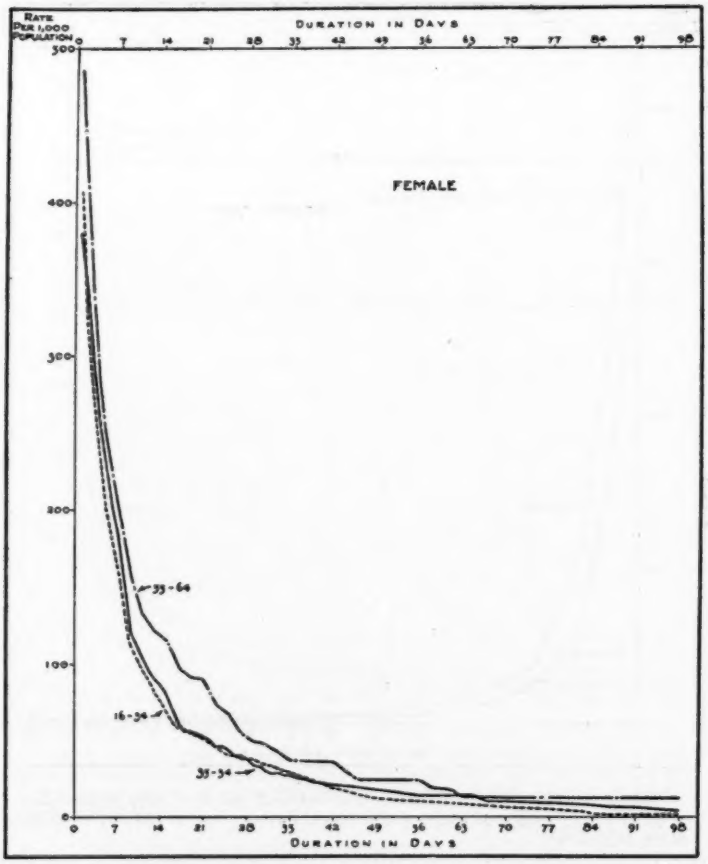


Fig. 5. Annual rate of acute illness and nonoccupational accidents with specified days of disability or more among employed females of different ages. Eastern Health District of Baltimore, 1938–1943.

periods of disability (Figures 6 and 7). For each sex, however, the decline was more rapid for respiratory diseases and digestive diseases than for nonoccupational accidents. The rapid decline continued through the fifteenth specified day for respiratory diseases and through the fifth specified day for digestive diseases. For "all other illness" the decline in the rate

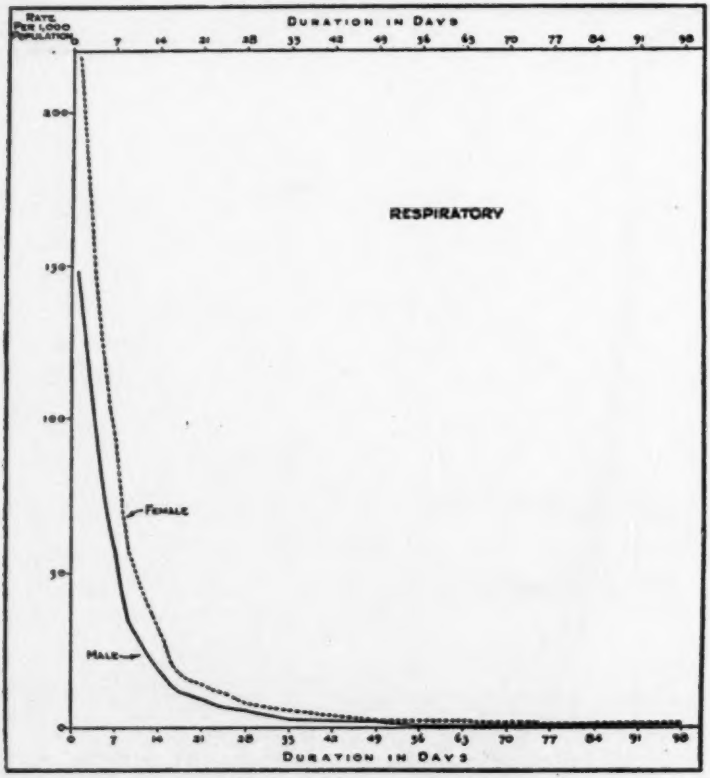


Fig. 6. Annual rate of respiratory diseases with specified days of disability or more among employed males and females. Eastern Health District of Baltimore, 1938–1943.

among females showed a general similarity to the decline for digestive diseases, but the decline among males was more like the decline for nonoccupational accidents, during the early specified days. The rate of disabling illnesses due to each diagnosis was small for all specified durations of more than two to three weeks of disability.

The proportionate decline in the illness rate with exclusion of sicknesses causing 3, 7, 10, or 14 disabling days, was determined for each diagnosis group and presented in Table 7. For

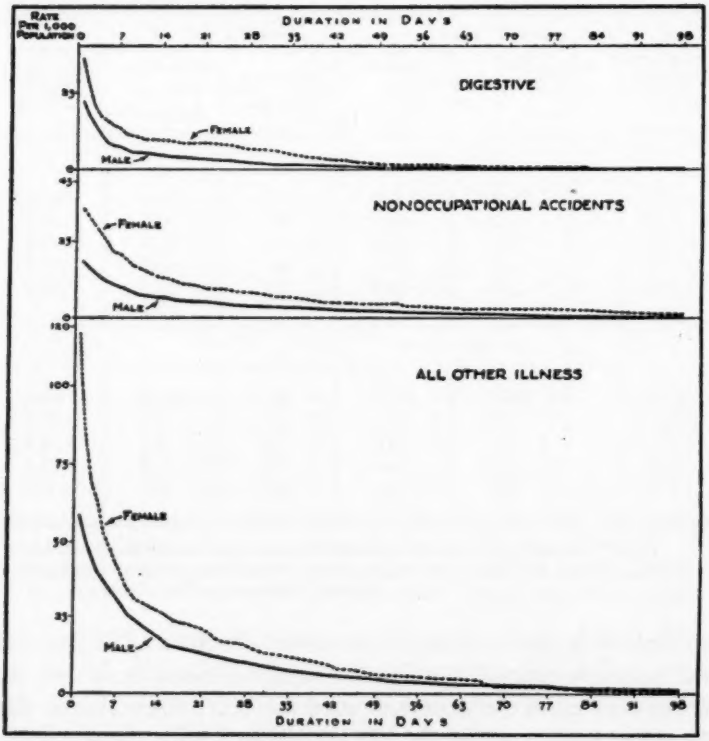


Fig. 7. Annual rate of digestive diseases, nonoccupational accidents, and other nonrespiratory nondigestive illness with specified days of disability or more among employed males and females. Eastern Health District of Baltimore, 1938–1943.

each sex about one-third of the respiratory diseases caused more than a week of disability and roughly one-eighth of them resulted in more than two weeks of disability. On the other hand, a little over half of the nonoccupational accidents caused more than a week of disability and slightly more than a third of them resulted in over two weeks of disability for each sex.

The distribution of illnesses with successive specified durations or more among the four broad diagnosis groups differed considerably as a result of differences in the proportionate decline in the illness rate for each diagnosis group (Table 8). For

Duration in Days	All Diagnoses	Diagnosis Group			
		Respiratory Diseases	Digestive Diseases	Nonoccupational Accidents	All Other Illness
	MALE				
1	100.0	100.0	100.0	100.0	100.0
4	63.7	63.3	49.7	69.7	68.2
8	35.5	29.3	28.3	51.6	48.8
11	25.4	18.5	24.8	41.0	38.3
15	17.5	10.6	20.0	34.4	28.3
	FEMALE				
1	100.0	100.0	100.0	100.0	100.0
4	60.9	64.6	47.4	77.4	53.2
8	35.2	33.8	32.6	54.8	32.8
11	24.6	21.0	27.4	41.9	25.3
15	18.3	12.3	25.3	36.6	21.8

Table 7. Proportion of disabling acute illnesses, classified by diagnosis, and nonoccupational accidents with specified days of disability or more. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

example, respiratory diseases accounted for close to 60 per cent and nonoccupational accidents roughly one-tenth of the illnesses with more than three days of disability for each sex. On the other hand, respiratory diseases caused only about a third and nonoccupational accidents approximately one-sixth of the illnesses with more than two weeks of disability for each sex.

Disabling Days in Specified Periods After Onset

Rates of disabling days occurring through specified days after the onset of disability are given in Figures 8, 10, and 11. The rates presented on each successive day show the cumulative effect of adding disability due to each subsequent day after the onset of disability to disability occurring on all preceding days of the illness. Rates through each day include disabling days due to *all* illnesses even though the illness may have terminated by the specified day or may continue beyond the specified day. Thus, rates for the first day include the first disabling day of

Duration in Days	All Diagnoses	Diagnosis Group			
		Respiratory Diseases	Digestive Diseases	Nonoccupational Accidents	All Other Illness
	MALE				
1	100.0	59.9	9.0	7.5	23.6
4	100.0	59.5	7.0	8.3	25.2
8	100.0	49.5	7.1	11.0	32.4
11	100.0	43.5	8.8	12.2	35.5
15	100.0	36.5	10.3	14.9	38.3
	FEMALE				
1	100.0	53.5	8.9	8.7	28.9
4	100.0	56.8	6.9	11.1	25.2
8	100.0	51.3	8.2	13.6	26.9
11	100.0	45.6	9.9	14.8	29.7
15	100.0	35.9	12.3	17.4	34.4

Table 8. Distribution of acute illnesses with specified days of disability or more among different diagnosis groups. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

every illness. Rates for the second day include disability due to the first day of disability for all illnesses plus disability due to the second day of all illnesses causing two days of disability and so on.

Rates of disabling days excluding disability occurring prior to a certain day after onset or after a certain period following onset, or both, can be determined from Figures 8, 10, and 11 as follows. Subtraction of the rate for any specified day from the total rate of disabling days gives a rate of disabling days from which all disability prior to the indicated day is excluded. The resulting rate is similar in nature to one obtained under an insurance plan with a specified waiting period but no limit on the benefit period. The rate given for any specified day excludes all disability occurring after the particular day. It represents the same type of rate as one for an insurance plan which limits the period during which benefits are provided but imposes no waiting period. Subtraction of the rate shown for any

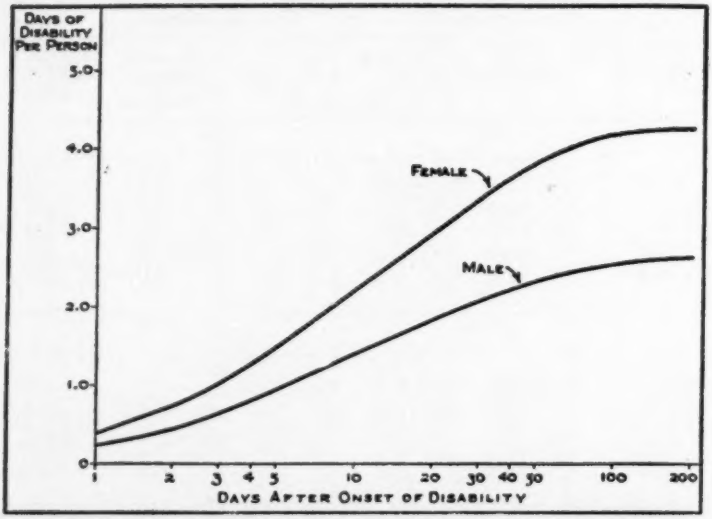


Fig. 8. Annual rate of disabling days from the onset of disability through specified days after onset, resulting from acute illness and nonoccupational accidents among employed males and females. Eastern Health District of Baltimore, 1938–1943.

specified day from the rate for any subsequent day gives the rate of disabling days occurring between the two days. It is the procedure by which rates comparable in nature to ones for any different combination of waiting and benefit periods under insurance plans can be obtained.

The rate of disabling days increased rapidly during the early specified days after onset but very slowly after the first three months of disability (Figure 8). The annual rate of disabling days per male, for example, was 1.2 through the first week, 1.6 through the second week, 2.5 through the thirteenth week, and 2.6 through the twenty-sixth week after onset of disability. The rate per female was 1.8, 2.6, 4.2, and 4.3 at the end of corresponding periods. For females the rate of disabling days at the end of twenty-six weeks after onset was the same as the rate of all disabling days annually. For males it was only slightly lower than the rate for all disabling days.

The large change in the rate of disabling days within short

Days After Onset of Disability	Period After Specified Day		
	Entire Period	26 Weeks	13 Weeks
	Rate Per 1,000 Population		
	MALE		
1	2,638.8	2,632.4	2,535.5
4	1,984.3	1,978.8	1,889.9
8	1,465.8	1,461.6	1,382.2
11	1,235.9	1,232.5	1,159.6
15	1,014.3	1,012.1	947.5
	FEMALE		
1	4,279.2	4,279.2	4,169.5
4	3,250.7	3,250.7	3,150.9
8	2,430.1	2,430.1	2,342.1
11	2,057.5	2,057.5	1,977.5
15	1,695.6	1,695.6	1,625.9

Table 9. Annual rate of disabling days due to acute illness and nonoccupational accidents included from the beginning of specified days after onset of disability through different periods of time after the specified days. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

periods after onset means, of course, that exclusion of early disability from the total rate of disabling days greatly reduces it. On the other hand, exclusion of disability occurring after the first several months following onset has little effect on the rate of disabling days. For example, the rate of disabling days declined sharply for each sex when disability occurring within three, seven, ten, or fourteen days after onset was excluded. The rate after each specified day was, however, very similar when based on disability occurring within twenty-six weeks, thirteen weeks or an unlimited period after the specified day (Table 9). The proportion of all disabling days included from the beginning of each of the first fifteen days after onset of disability through twenty-six weeks after the specified day is shown for each sex in Figure 9.

The rate of disabling days through different specified days after onset was consistently higher among females than among males at each specific age (Figure 10). The excess was of simi-

lar relative magnitude through most of the specified days.

The rate of disabling days occurring through specified days after onset differed somewhat by age (Figure 10; Appendix Table 10). Among males the rate at ages 16–34 was slightly above the rate at ages 35–54 through each specified day. On the other hand, among females the rate at ages 35–54 was above the rate at ages 16–34 for all specified days after the first. For each sex the rate of disabling days at ages 55–64 was higher than the rate for the two younger age groups for every specified day. The excess for the oldest age group compared with younger age groups was relatively greater for specified days more than two to three weeks after the onset than for early specified days after onset of disability.

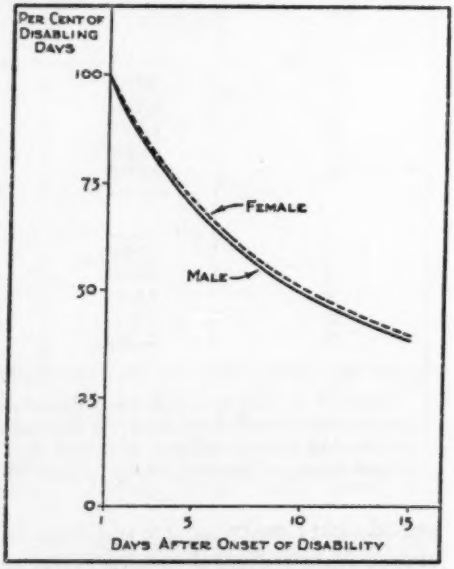


Fig. 9. Proportion of disabling days due to acute illness and nonoccupational accidents included from the beginning of specified days following onset of disability through 26 weeks after the specified days. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

Rates of disabling days due to each of the four diagnosis groups of illness showed considerable difference in magnitude through most of the specified days after onset of disability (Figure 11). The rate of days due to respiratory diseases was consistently the highest, followed successively by "all other illness," nonoccupational accidents (at most specified days), and digestive diseases. For each sex the rate due to respiratory diseases rose particularly rapidly during the first fifteen specified days and then more slowly. In comparison, the rate of days

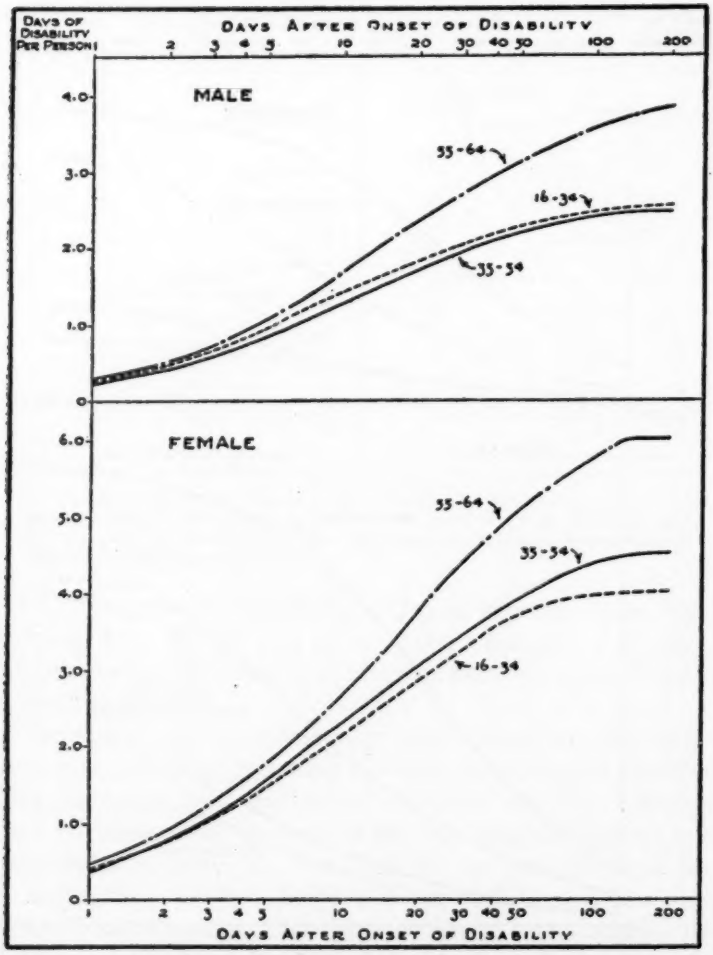


Fig. 10. Annual rate of disabling days from the onset of disability through specified days after onset, resulting from acute illness and nonoccupational accidents among employed males and females of different ages. Eastern Health District of Baltimore, 1938–1943.

due to "all other illness" increased more rapidly than the rate due to respiratory diseases for most specified days after the fifteenth (especially among males). The rate due to digestive

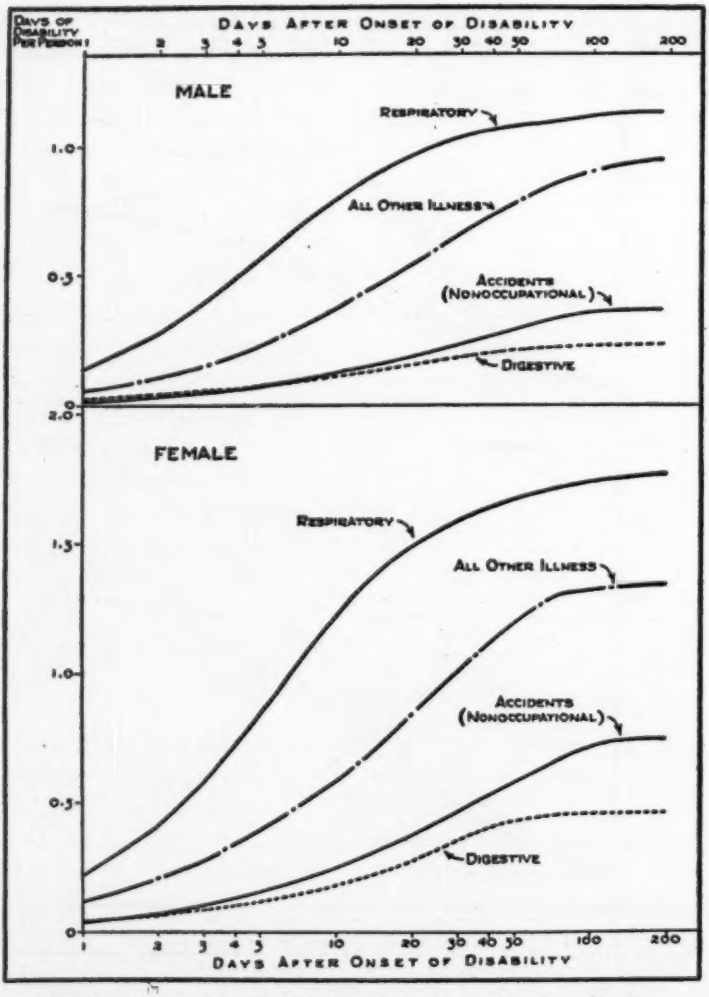


Fig. 11. Annual rate of disabling days from the onset of disability through specified days after onset, resulting from acute illness (classified by diagnosis) and nonoccupational accidents among employed males and females. Eastern Health District of Baltimore, 1938–1943.

diseases increased slowly for most of the specified durations. The rate of days due to nonoccupational accidents also rose

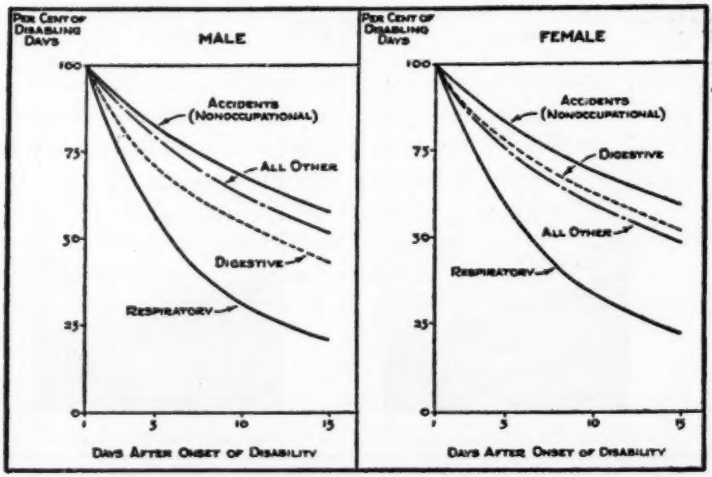


Fig. 12. Proportion of disabling days, classified by diagnosis, included from the beginning of specified days after onset of acute disabling illness through 26 weeks after the specified days. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

slowly during the early specified days, but showed a more rapid increase than the rate due to respiratory diseases or digestive diseases for specified durations after the first two to three weeks of disability.

The proportionate decline in the rate of disabling days when limited to disability occurring from the beginning of specified days after onset through twenty-six weeks after the specified days was determined for each of the four diagnosis groups and presented in Figure 12. For each sex the rate of days due to respiratory diseases declined most rapidly and the rate due to nonoccupational accidents dropped least rapidly. An interesting difference between the sexes was the more rapid decline in the rate of disabling days due to digestive diseases among males than among females through the fifteen indicated days.

The distribution by diagnosis of disabling days included from the beginning of each of the first fifteen days after onset of disability through twenty-six weeks after the specified

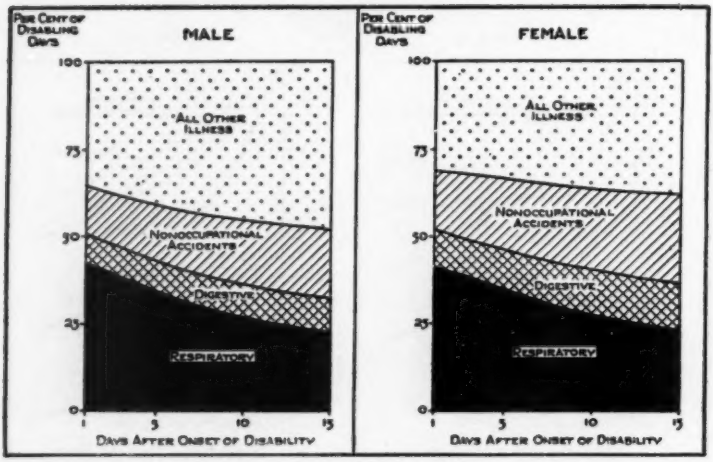


Fig. 13. Distribution by diagnosis of disabling days included from the beginning of specified days following onset of disabling acute illness through 26 weeks after the specified days. Employed males and females, Eastern Health District of Baltimore, 1938–1943.

days differed considerably (Figure 13). For each sex respiratory diseases caused a declining proportion and nonoccupational accidents and "all other illness" accounted for increasing proportions of disabling days limited to the successively longer duration disabilities. The relative importance of disabling days due to digestive diseases showed little change among males but increased somewhat among females at the successive indicated days.

Discussion

As indicated earlier, rates of disabling illness and disabling days presented in this paper cannot be considered strictly representative of rates to be anticipated under insurance plans for various population groups. Disability rates differ with the kind of employment and the nature of the working conditions. They change over time, both with the extent of employment and the progress of medical advance. Particularly, they are affected by the provision of insurance protection. For any individual insurance plan they are also influenced

by the types of illness for which coverage is provided (10,11, 13–15, 23).

When full recognition is given to such limitations, however, the following generalizations can be made regarding the effect of adoption of specific waiting and benefit periods on disability rates to be expected under insurance plans providing for acute, disabling illness among employed persons.

(1) Imposition of a short waiting period will reduce the rates of disabling illness and disabling days sharply. The extent of the reduction is likely to differ considerably for waiting periods of three, seven, or ten days.

(2) Limitation of the benefit period to any length of time greater than three months, such as thirteen or twenty-six weeks, will have little effect on the rate of disabling days.

(3) Differences in the rate of disabling illness and disabling days by age may change in relative magnitude when limited to disability occurring after specified waiting periods. For example, excesses in the rate among older persons compared with younger persons may be relatively greater for the longer duration disabilities (after the waiting period) than for illness of all durations.

(4) The distribution of disabling illnesses and disabling days according to diagnosis can be expected to differ when based on disability occurring after different waiting periods. Particularly, the relative importance of disability due to respiratory diseases is likely to decrease under successively longer waiting periods.

Summary

Data have been presented on the incidence and duration of disabling acute illnesses (including nonoccupational accidents) among 6,515 employed males and 2,625 employed females in the Eastern Health District of Baltimore from 1938 to 1943. Particular attention has been given to rates of disability within different specified periods following the onset of disability.

The annual rate of disabling illness was 248 per 1,000 males and 407 per 1,000 females. The illness caused three disabling days per male and four disabling days per female each year. The rate of illness among females and the rate of disabling days for each sex was higher at ages 55–64 than at younger ages.

Respiratory diseases were the primary cause of disability. They accounted for 50–60 per cent of the disabling illnesses and approximately 40 per cent of the disabling days for each sex. Nonoccupational accidents and digestive diseases were the other chief causes of disability.

Most of the illnesses caused short periods of disability. Approximately two-thirds of the illnesses caused a week or less of disability. About 40 per cent of the disabling days due to all illnesses occurred within a week after the onset of disability.

The duration of disability was similar for the two sexes. It differed somewhat by age, however. For example, for each sex, a higher proportion of disabling days occurred after the first week of disability at ages 55–64 than at younger ages.

Respiratory diseases and digestive diseases caused shorter periods of disability than nonoccupational accidents. Approximately a third of the respiratory diseases and digestive diseases, but slightly more than half of the nonoccupational accidents, caused more than a week of disability for each sex. Approximately 40 per cent of the disabling days due to respiratory diseases, but almost three-fourths of the disabling days due to nonoccupational accidents, occurred after the first week of disability.

Data presented in this paper suggest two general conclusions relative to the effect of adoption of waiting and benefit periods on rates of disabling illness and disabling days to be expected under disability insurance plans providing coverage for acute disabling illness (and nonoccupational accidents) among employed persons. Imposition of waiting periods, such as three, seven, or ten days, can be expected to result in a sharp

decline in the rate of illness and days. On the other hand, limitation of the benefit period will have no effect on the illness rate and is likely to have little influence on the rate of days if the benefit period is more than several months in length.

Acknowledgments

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Appendix Table 1. Number of acute illnesses and nonoccupational accidents with specified days of disability[1] or more, among employed males and females of different ages. Eastern Health District of Baltimore, 1938–1943.

Duration in Days	All Ages		Age Group					
			16–34		35–54		55–64	
	Male	Female	Male	Female	Male	Female	Male	Female
1	1,616	1,067	826	673	615	314	175	80
2	1,413	880	707	536	550	276	156	68
3	1,235	753	608	456	484	240	143	57
4	1,030	650	498	394	405	209	127	47
5	885	560	421	335	352	184	112	41
6	774	496	379	299	297	163	98	34
7	689	448	334	266	263	148	92	34
8	574	376	268	225	227	124	79	27
9	482	313	219	190	190	97	73	26
10	442	289	198	173	176	90	68	26
11	411	263	180	158	166	83	65	22
12	370	248	163	149	146	77	61	22
13	347	226	154	134	135	72	58	20
14	316	213	141	125	126	69	49	19
15	282	195	124	112	113	64	45	19
16	249	174	109	102	101	55	39	17
17	236	159	104	95	97	48	35	16
18	227	154	99	94	95	45	33	15
19	217	150	93	90	94	45	30	15
20	207	147	89	88	90	44	28	15
21	200	140	87	84	85	41	28	15
22	185	133	80	80	78	40	27	13
23	174	125	74	76	73	37	27	12
24	166	118	71	70	69	37	26	11
25	162	113	70	67	66	35	26	11
26	151	108	64	66	63	32	24	10
27	145	105	60	64	62	32	23	9
28	139	101	58	63	58	30	23	8
35	96	76	46	48	34	22	16	6
42	75	55	33	32	30	17	12	6
49	60	38	26	20	24	14	10	4
56	42	32	17	17	18	11	7	4
63	37	27	13	14	17	11	7	2
70	32	20	11	10	15	8	6	2
77	26	17	10	8	10	7	6	2
84	23	11	9	3	9	6	5	2
91	20	9	8	2	7	5	5	2
98	16	7	7	2	6	3	3	2
105	15	6	6	2	6	3	3	1
119	8	4	2	1	4	2	2	1
133	5	2	1	1	2	1	2	0
147	4	2	1	1	1	1	2	0
161	2	2	1	1	0	1	1	0
175	2	1	1	1	0	0	1	0
189	2	0	1	0	0	0	1	0
203	2	0	1	0	0	0	1	0

[1] Excluding partially disabling days.

Duration in Days	All Diagnoses		Diagnosis Group							
			Respiratory		Digestive		Nonoccupational Accidents		All Other Illness	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	1,616	1,067	968	571	145	95	122	93	381	308
2	1,413	880	859	500	114	71	106	86	334	223
3	1,235	753	745	438	96	53	97	79	297	183
4	1,030	650	613	369	72	45	85	72	260	164
5	885	560	510	316	57	41	78	65	240	138
6	774	496	428	277	51	37	73	56	222	126
7	689	448	368	245	48	36	67	55	206	112
8	574	376	284	193	41	31	63	51	186	101
9	482	313	227	152	37	29	54	44	164	88
10	442	289	199	135	37	28	50	44	156	82
11	411	263	179	120	36	26	50	39	146	78
12	370	248	153	107	33	26	47	39	137	76
13	347	226	143	93	31	26	46	35	127	72
14	316	213	120	83	30	25	45	35	121	70
15	282	195	103	70	29	24	42	34	108	67
16	249	174	86	54	28	24	37	33	98	63
17	236	159	76	47	26	23	37	29	97	60
18	227	154	71	43	25	23	37	29	94	59
19	217	150	67	40	23	23	36	29	91	58
20	207	147	64	40	23	23	34	28	86	56
21	200	140	59	36	22	23	34	26	85	55
22	185	133	51	35	20	22	33	25	81	51
23	174	125	47	30	20	22	30	25	77	48
24	166	118	44	29	20	21	29	25	73	43
25	162	113	41	25	20	21	29	24	72	43
26	151	108	39	24	18	20	26	22	68	42
27	145	105	37	23	16	18	26	22	66	42
28	139	101	34	20	15	18	26	22	64	41
35	96	76	15	14	11	13	22	18	48	31
42	75	55	11	10	8	8	18	13	38	24
49	60	38	10	5	5	5	15	12	30	16
56	42	32	5	5	3	3	12	10	22	14
63	37	27	5	5	2	3	10	8	20	11
70	32	20	5	4	1	1	8	8	18	7
77	26	17	5	3	1	1	6	8	14	5
84	23	11	5	3	1	0	5	6	12	2
91	20	9	5	3	1	0	5	5	9	1
98	16	7	4	2	1	0	4	4	7	1
105	15	6	4	1	1	0	4	4	6	1
119	8	4	1	1	1	0	2	2	4	1
133	5	2	1	1	1	0	0	0	3	1
147	4	2	1	1	0	0	0	0	3	1
161	2	2	0	1	0	0	0	0	2	1
175	2	1	0	0	0	0	0	0	2	1
189	2	0	0	0	0	0	0	0	2	0
203	2	0	0	0	0	0	0	0	2	0

Appendix Table 2. Number of acute illnesses, classified by diagnosis, and nonoccupational accidents with specified days of disability or more, among employed males and females, 16–64 years of age. Eastern Health District of Baltimore, 1938–1943.

Days After Onset of Disability	All Ages		Age Group					
			16–34		35–54		55–64	
	Male	Female	Male	Female	Male	Female	Male	Female
1	1,616	1,067	826	673	615	314	175	80
2	3,029	1,947	1,533	1,209	1,165	590	331	148
3	4,264	2,700	2,141	1,665	1,649	830	474	205
4	5,294	3,350	2,639	2,059	2,054	1,039	601	252
5	6,179	3,910	3,060	2,394	2,406	1,223	713	293
6	6,953	4,406	3,439	2,693	2,703	1,386	811	327
7	7,642	4,854	3,773	2,959	2,966	1,534	903	361
8	8,216	5,230	4,041	3,184	3,193	1,658	982	388
9	8,698	5,543	4,260	3,374	3,383	1,755	1,055	414
10	9,140	5,832	4,458	3,547	3,559	1,845	1,123	440
11	9,551	6,095	4,638	3,705	3,725	1,928	1,188	462
12	9,921	6,343	4,801	3,854	3,871	2,005	1,249	484
13	10,268	6,569	4,955	3,988	4,006	2,077	1,307	504
14	10,584	6,782	5,096	4,113	4,132	2,146	1,356	523
21	12,202	7,901	5,801	4,778	4,807	2,488	1,594	635
28	13,324	8,704	6,278	5,264	5,276	2,731	1,770	709
35	14,116	9,303	6,636	5,643	5,580	2,899	1,900	761
42	14,700	9,743	6,901	5,912	5,802	3,028	1,997	803
49	15,160	10,056	7,097	6,086	5,991	3,138	2,072	832
56	15,492	10,291	7,234	6,209	6,129	3,222	2,129	860
63	15,761	10,495	7,332	6,316	6,251	3,299	2,178	880
70	15,998	10,655	7,418	6,397	6,359	3,364	2,221	894
77	16,197	10,780	7,492	6,459	6,442	3,413	2,263	908
84	16,364	10,879	7,559	6,500	6,505	3,457	2,300	922
91	16,519	10,945	7,620	6,516	6,564	3,493	2,335	936
98	16,647	11,002	7,673	6,530	6,611	3,522	2,363	950
105	16,757	11,050	7,720	6,544	6,653	3,543	2,384	963
119	16,917	11,110	7,783	6,558	6,716	3,575	2,418	977
133	17,001	11,151	7,805	6,572	6,750	3,589	2,446	990
147	17,065	11,179	7,819	6,586	6,772	3,603	2,474	990
161	17,108	11,207	7,833	6,600	6,776	3,617	2,499	990
175	17,136	11,228	7,847	6,614	6,776	3,624	2,513	990
189	17,164	11,233	7,861	6,619	6,776	3,624	2,527	990
203	17,192	11,233	7,875	6,619	6,776	3,624	2,541	990

Appendix Table 3. Number of disabling days from the onset of disability through specified days after onset, resulting from acute illness and nonoccupational accidents, among employed males and females of different ages. Eastern Health District of Baltimore, 1938–1943.

ing from acute illness, classified by diagnosis, and nonoccupational accidents, among employed males and females, 16–64 years of age. Eastern Health District of Baltimore, 1938–1943.

Days After Onset of Disability	All Diagnoses		Diagnosis Group							
			Respiratory		Digestive		Nonoccupational Accidents		All Other Illness	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
1	1,616	1,067	968	571	145	95	122	93	381	308
2	3,029	1,947	1,827	1,071	259	166	228	179	715	531
3	4,264	2,700	2,572	1,509	355	219	325	258	1,012	714
4	5,294	3,350	3,185	1,878	427	264	410	330	1,272	878
5	6,179	3,910	3,695	2,194	484	305	488	395	1,512	1,016
6	6,953	4,406	4,123	2,471	535	342	561	451	1,734	1,142
7	7,642	4,854	4,491	2,716	583	378	628	506	1,940	1,254
8	8,216	5,230	4,775	2,909	624	409	691	557	2,126	1,355
9	8,698	5,543	5,002	3,061	661	438	745	601	2,290	1,443
10	9,140	5,832	5,201	3,196	698	466	795	645	2,446	1,525
11	9,551	6,095	5,380	3,316	734	492	845	684	2,592	1,603
12	9,921	6,343	5,533	3,423	767	518	892	723	2,729	1,679
13	10,268	6,569	5,676	3,516	798	544	938	758	2,856	1,751
14	10,584	6,782	5,796	3,599	828	569	983	793	2,977	1,821
21	12,202	7,901	6,322	3,929	1,004	732	1,240	1,001	3,636	2,239
28	13,324	8,704	6,615	4,115	1,133	874	1,439	1,166	4,137	2,549
35	14,116	9,303	6,775	4,232	1,224	985	1,603	1,302	4,514	2,784
42	14,700	9,743	6,857	4,311	1,290	1,053	1,741	1,404	4,812	2,975
49	15,160	10,056	6,929	4,359	1,333	1,098	1,851	1,491	5,047	3,108
56	15,492	10,291	6,982	4,394	1,355	1,120	1,942	1,567	5,213	3,210
63	15,761	10,495	7,017	4,429	1,372	1,141	2,014	1,629	5,358	3,296
70	15,998	10,655	7,052	4,457	1,380	1,156	2,076	1,685	5,490	3,357
77	16,197	10,780	7,087	4,482	1,387	1,163	2,122	1,741	5,601	3,394
84	16,364	10,879	7,122	4,503	1,394	1,168	2,161	1,791	5,687	3,417
91	16,519	10,945	7,157	4,524	1,401	1,168	2,196	1,827	5,765	3,426
98	16,647	11,002	7,191	4,544	1,408	1,168	2,225	1,857	5,823	3,433
105	16,757	11,050	7,219	4,557	1,415	1,168	2,253	1,885	5,870	3,440
119	16,917	11,110	7,254	4,571	1,429	1,168	2,297	1,917	5,937	3.454
133	17,001	11,151	7,268	4,585	1,443	1,168	2,309	1,930	5,981	3,468
147	17,065	11,179	7,282	4,599	1,451	1,168	2,309	1,930	6,023	3,482
161	17,108	11,207	7,286	4,613	1,451	1,168	2,309	1,930	6,062	3,496
175	17,136	11,228	7,286	4,620	1,451	1,168	2,309	1,930	6,090	3,510
189	17,164	11,233	7,286	4,620	1,451	1,168	2,309	1,930	6,118	3,515
203	17,192	11,233	7,286	4,620	1,451	1,168	2,309	1,930	6,146	3,515

Duration in Days	Rate Per 1,000 Population		Number	
	Male	Female	Male	Female
1	23.8	11.8	155	31
4	18.7	8.8	122	23
8	14.1	6.9	92	18
11	11.4	5.3	74	14
15	8.9	4.6	58	12

Appendix Table 5. Annual rate of occupational accidents with specified days of disability or more, among employed males and females. Eastern Health District of Baltimore, 1938–1943.

Days After Onset of Disability	Weeks From Specified Day After Onset			
	Twenty-Six Weeks		Thirteen Weeks	
	Male	Female	Male	Female
	rate per 1,000 population			
1	506.8	220.6	459.2	212.2
4	442.1	187.0	396.8	179.8
8	375.1	153.1	332.5	147.4
11	336.6	133.7	295.8	129.1
15	296.7	113.5	258.2	110.5
	number			
1	3,302	579	2,992	557
4	2,880	491	2,585	472
8	2,444	402	2,166	387
11	2,193	351	1,927	339
15	1,933	298	1,682	290

Appendix Table 6. Annual rate of disabling days due to occupational accidents included from the beginning of specified days following onset of disability through 26 weeks and 13 weeks, after the specified days. Employed males and females. Eastern Health District of Baltimore, 1938–1943.

Duration in Days	Rate Per 1,000 Population	Number
1	11.0	29
4	10.7	28
8	9.5	25
11	8.0	21
15	6.9	18

Appendix Table 7. Annual rate of pregnancies with specified days of disability or more among employed females. Eastern Health District of Baltimore, 1938–1943.

Days After Onset of Disability	Weeks From Specified Day After Onset	
	Twenty-Six Weeks	Thirteen Weeks
	RATE PER 1,000 FEMALES	
1	296.8	267.8
4	264.4	237.7
8	223.2	199.6
11	195.8	173.3
15	166.1	145.1
	NUMBER	
1	779	703
4	694	624
8	586	524
11	514	455
15	436	381

Appendix Table 8. Annual rate of disabling days due to pregnancies included from the beginning of specified days following onset of disability through 26 weeks and 13 weeks, after the specified days. Employed females, Eastern Health District of Baltimore, 1938–1943.

Appendix Table 9. Annual rate of disabling acute illness and nonoccupational accidents with specified days of disability or more. Employed males and females of different ages, Eastern Health District of Baltimore, 1938–1943.

Duration in Days	Ages 16–64	Age Group		
		16–34	35–54	55–64
	MALE			
1	248.0	265.6	223.9	266.0
4	158.1	160.1	147.4	193.0
8	88.1	86.2	82.6	120.1
11	63.1	57.9	60.4	98.8
15	43.3	39.9	41.1	68.4
	FEMALE			
1	406.5	406.4	390.5	484.8
4	247.6	237.9	260.0	284.8
8	143.2	135.9	154.2	163.6
11	100.2	95.4	103.2	133.3
15	74.3	67.6	79.6	115.1

Days After Onset of Disability	Ages 16–64	Age Group		
		16–34	35–54	55–64
	Rate Per 1,000 Population			
	MALE			
1	2,632.4	2,525.4	2,466.7	3,829.8
4	1,978.8	1,837.9	1,866.4	3,114.0
8	1,461.6	1,314.5	1,387.0	2,468.1
11	1,232.5	1,095.2	1,171.1	2,138.3
15	1,012.1	891.3	962.5	1,790.3
	FEMALE			
1	4,279.2	3,997.0	4,507.5	6,000.0
4	3,250.7	2,991.5	3,475.1	4,757.6
8	2,430.1	2,210.1	2,599.5	3,812.1
11	2,057.5	1,855.1	2,212.7	3,333.3
15	1,695.6	1,513.3	1,838.3	2,830.3

Appendix Table 10.. Annual rate of disabling days due to acute illness and nonoccupational accidents included from the beginning of specified days after onset of disability through 26 weeks after the specified days. Employed males and females of different ages, Eastern Health District of Baltimore, 1938–1943.

SOCIAL AND PSYCHOLOGICAL FACTORS AFFECTING FERTILITY

XIII. FERTILITY IN RELATION TO FERTILITY PLANNING AND HEALTH OF WIFE, HUSBAND, AND CHILDREN[1]

LEE F. HERRERA AND CLYDE V. KISER

ONE of the traditional arguments for family limitation in economically depressed areas is that excessive childbirth is detrimental to the health of mothers and children. The professed aim of planned parenthood groups is that of promoting maternal and child health and this same goal has led many health departments to incorporate contraceptive service into their maternal health activities. Developments of this type have been especially striking in Southern states of high fertility in recent years.

The above statements are concerned with the effect of excessive fertility on health. There is also the reverse problem of the effect of health on fertility. The medical aspects of this problem are rather obvious and are largely those of sterility and pathologies affecting fecundity. The present paper is not concerned with the medical or physiological aspects of the problem but rather with the bearing of health as a social or psychological factor affecting fertility planning and size of planned family. In fact, the analysis is restricted to "relatively fecund" couples. The "relatively sterile" couples are excluded from the analysis.

This paper is a report on two of the twenty-three hypotheses that were formulated for testing in the Study of Social and Psychological Factors Affecting Fertility.[2] The hypotheses were as follows:

The poorer the health of the husband and/or wife, the higher

[1] This is the thirteenth of a series of reports on a study conducted by the Committee on Social and Psychological Factors Affecting Fertility, sponsored by the Milbank Memorial Fund with grants from the Carnegie Corporation of New York. The Committee consists of Lowell J. Reed, Chairman; Daniel Katz; E. Lowell Kelly; Clyde V. Kiser; Frank Lorimer; Frank W. Notestein; Frederick Osborn; S. A. Switzer; Warren S. Thompson; and P. K. Whelpton.

[2] The general purpose, scope, and methods of the Study have been described in

(Continued on page 332)

the proportion of couples practicing contraception effectively, and the smaller the planned families.

The poorer the health of children, the higher the proportion of couples practicing contraception effectively, and the smaller the planned families.

It will be noted that the hypothesized health-fertility relation among planned families is opposite to that discussed in the first paragraph. When the hypotheses were formulated it was assumed that although excessive fertility may impair the health of mother and children, good health of wife, husband, and children are positive factors in the planning of additional children and hence are directly related to fertility among planned families.

The three types of measures needed for testing the hypotheses are those of fertility, fertility-planning status, and health. The chief measure of fertility used in this Study is number of live births per 100 couples. This is not standardized for age because the data are restricted to couples of similar (12–15 years) duration of marriage, with wife under 30 and husband under 40 at the time of marriage.

The classification of couples by fertility-planning status has been described in previous reports.[8] Briefly stated, it is based upon histories of contraceptive practice and attitudes toward each pregnancy and consists of the four broad groups: number

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detail in previous articles. The Study was conducted in Indianapolis in 1941 and the data for the present analysis relate to an adjusted sample of 1,444 "relatively fecund" couples with the following characteristics: husband and wife native white, both Protestant, both finished at least the eighth grade, married during 1927–1929, neither previously married, husband under 40 and wife under 30 at marriage, and eight or more years spent in a city of 25,000 population or over since marriage. Couples with these characteristics were located by means of a preliminary Household Survey of virtually all white households in Indianapolis.

For purposes of the Study, all couples with four or more live births were classified as "relatively fecund" regardless of other circumstances. Couples with 0–3 live births were classified as "relatively fecund" unless they knew or had good reason for believing that conception was physiologically impossible during a period of at least 24 or 36 consecutive months since marriage (24 for never-pregnant couples, 36 for others). Failure to conceive when contraception was not practiced "always" or "usually" during periods of above durations was considered "good reason" for such belief. Couples not classified as "relatively fecund" were considered "relatively sterile."

[8] *See especially* Whelpton, P. K. and Kiser, Clyde V.: Social and Psychological Factors Affecting Fertility. VI. The Planning of Fertility. The Milbank Memorial Fund *Quarterly*, January, 1947, xxv, No. 1, pp. 63–111 (Reprint pp. 209–257).

and spacing planned, number planned, quasi-planned, and excess fertility.[4] Couples in the first two categories are regarded as "planned families" and as having "practiced contraception effectively."

With respect to health, it is acknowledged at the outset that the measures available from the Indianapolis Study are very inadequate. The Indianapolis Study did not presume to be a health survey and no effort was made to secure detailed data on type, duration, and severity of illnesses experienced by the people in the Study. The data that are available are described under each of the two hypotheses which will be separately considered.

Health of Wife and Husband

The classifications by health of wife and husband are based mainly upon "multiple choice" replies to several pertinent questions. The form on which these questions appeared was filled out by the wife and husband separately, in the presence of the interviewer, usually at a prearranged evening appointment in the home of the couple. The questions and possible replies are as follows:

How well have you been most of the time since marriage? (Excellent health, very good, good, fair, poor.)

How much has the poor health or physical condition of your-

[4] The four categories may be briefly described as follows:

Number and Spacing of Pregnancies Planned. The 403 couples in this group exhibit the most complete planning of fertility in that they had no pregnancies that were not deliberately planned by stopping contraception in order to conceive. The group consists of two major subdivisions: (a) 121 couples practicing contraception regularly and continuously and having no pregnancy, and (b) 282 couples whose every pregnancy was deliberately planned by interrupting contraception in order to conceive.

Number Planned. This group of 205 couples consists mainly of those whose *last* pregnancy was deliberately planned by stopping contraception in order to conceive but who had one or more previous pregnancies under other circumstances. Because of this, the couples are regarded as having planned the number but not the spacing of their pregnancies.

Quasi-Planned. This group includes 454 couples who did not deliberately plan the last pregnancy in the manner described above but who either wanted the last pregnancy or wanted another pregnancy.

Excess Fertility. This group is composed of 382 couples classified as least successful in planning size of family because one or more pregnancies had occurred after the last that was wanted.

Table 1. Percentage distribution of wives and husbands by self-appraisal of health, by fertility-planning and socio-economic status of the couple.

Self-Appraisal of Health	Total	Fertility-Planning Status				Socio-Economic Status		
		Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	High	Medium	Low
Number of Couples	1,444[a]	403	205	454	382[a]	224	566	654[a]
Wife								
Total	100.1	100.0	100.1	100.0	100.0	100.0	100.1	99.9
Poor	2.6	1.7	2.0	4.6	1.6	0.9	3.5	2.4
Fair	19.9	13.9	19.0	19.4	27.2	12.5	18.4	23.7
Good	23.1	22.6	22.0	23.8	23.3	20.5	22.3	24.6
Very Good	33.4	36.0	33.2	31.1	33.5	42.4	29.9	33.3
Excellent	21.1	25.8	23.9	21.1	14.4	23.7	26.0	15.9
Husband								
Total	100.0	100.1	100.0	99.9	100.0	99.9	100.1	100.0
Poor	1.2	2.5	0.0	0.2	1.6	2.2	0.4	1.5
Fair	10.2	5.7	10.2	11.2	13.7	2.2	8.3	14.6
Good	17.6	19.4	20.0	15.6	16.9	17.4	18.4	17.1
Very Good	35.6	34.5	32.2	36.1	38.0	29.0	35.2	38.2
Excellent	35.4	38.0	37.6	36.8	29.8	49.1	37.8	28.6

[a] Base for percentages smaller by three for husbands because of unknown health status.

self discouraged you and your husband [wife] from having [more] children?[5] (Discouraged very much, much, some, little, very little or not at all.)

How much has the poor health or physical condition of your husband [wife] discouraged you and your husband [wife] from having [more] children?[5] (Replies same as above.)

How much energy and pep do you ordinarily have? (Very little, little, somewhat less than average, about average, somewhat more than average, much, very much.)

How much energy and pep does your husband [wife] ordinarily have? (Replies same as above.)

The schedules also contained an "Interviewer's Rating Scale" in which the interviewer recorded her personal rating of the wife and husband on pep and energy in terms of the following: worn out—no reserves of energy, some pep and energy, average pep and energy, much pep and energy, unlimited pep and energy.

In addition, wives were asked:

How much risk to your health do you think you would run in having a [another] child?[6] How much risk to your health does your husband think you would run in having a [another] child?[6] (Much less than most women, somewhat less than most women, about average, somewhat more than most women, much more than most women, very much more than most women.)

Husbands were asked:

How much risk to her health do you think your wife would run in having a [another] child?[6] How much risk to her health does your wife think she would run in having a [another] child?[6] (Replies same as above.)

Distribution of the Replies. It will be noted in Table 1 that 54.5 per cent of the wives and 71 per cent of the husbands appraised their general health since marriage as "very good" or

[5] In the questionnaire for childless couples the question relates to "children" instead of "more children."

[6] In the questionnaire for childless couples, the question relates to "a child" instead of "another" child.

Table 2. Distribution by risk to wife's health in having another child according to wife's opinion, husband's opinion, wife's rating of husband's opinion, and husband's rating of wife's opinion.[1]

Risk to Wife's Health in Having Another Child	Number				Per Cent			
	Wife's Opinion	Husband's Opinion	Wife's Rating of Husband's Opinion	Husband's Rating of Wife's Opinion	Wife's Opinion	Husband's Opinion	Wife's Rating of Husband's Opinion	Husband's Rating of Wife's Opinion
Total	1,444	1,444	1,444	1,444	100.0	100.0	100.0	99.9
Very Much More Than Most Women	91	124	76	113	6.3	8.6	5.3	7.8
Much More Than Most Women	69	99	98	90	4.8	6.9	6.8	6.3
Somewhat More Than Most Women	254	298	296	219	17.6	20.6	20.5	15.2
About Average	884	753	838	808	61.2	52.1	58.2	56.1
Somewhat Less Than Most Women	49	117	65	110	3.4	8.1	4.5	7.6
Much Less Than Most Women	97	53	68	100	6.7	3.7	4.7	6.9
Unknown			3	4				

[1] For childless couples the data relate to health risk in having "a child" rather than "another child."

"excellent." Only about 3 per cent of the wives and 1 per cent of the husbands replied that their health had been "poor."[7] For this reason the "poor" and "fair" categories are consolidated in the analyses and these together constitute only about 23 per cent of the wives' replies and 11 per cent of the husbands'.

Possibly because "pep and energy" may be interpreted as a "health plus" quality, the replies on this item are less skewed toward the high ratings than are those on general health. The distributions are given in detail in Appendix I. Only 9 per cent of the wives rated themselves as having "very much" pep and energy, 10 per cent as "much," 15 per cent as "somewhat more than average," 52 per cent as "about average," 9 per cent as "somewhat less than average," and 5 per cent as "very little or little" pep and energy. Below, the percentage distributions are shown for wife and husband in terms of three broad categories and based upon ratings by self, spouse and interviewer.[8]

Several points may be noted from the broad classification: (a) the ratings on pep and energy of the husband tend to be

[7] The characteristics of couples in the Study, described in footnote 2, probably help to account for the low proportion of wives and husbands rating their health as "poor." By virtue of the joint restrictions on year of marriage and age at marriage, all wives in the Study were under 45 years of age at interview and all husbands were under 55. The median ages at interview were 34.0 for wives and 36.5 for husbands in the Study sample of 1,444 relatively fecund couples. Another restriction of importance was that wives and husbands were to have at least a complete elementary school education.

[8]

Rating by	Below Average	About Average	Above Average
	Pep and Energy of Wife Per Cent		
Self	14	52	34
Spouse	12	51	37
Interviewer	25	41	34
	Pep and Energy of Husband Per Cent		
Self	7	51	42
Spouse	8	53	39
Interviewer	10	46	45

a little higher than those of the wife in the ratings by self, spouse, and interviewer; (b) the self-ratings and the ratings by spouse are distributed in much the same manner; and (c) the ratings by the interviewer differ from the others mainly with respect to higher proportion of wives rated as below average in pep and energy.[9]

Distributions by four types of ratings on risk to wife's health in having another child ("a child" if childless) are presented in Table 2. These are the wife's own opinion, husband's own opinion, wife's statement of husband's opinion, and husband's statement of wife's opinion. It will be noted that these four distributions do not differ greatly. In all of them, from 52 to 61 per cent of the ratings are "about average." The higher figure represents the wife's own opinion. Only about 11 per cent of the wives rated their health risk as being "very much" or "much" more than that confronted by most women, but an additional 18 per cent checked the category "somewhat more than most women." Only about 10 per cent rated their health risk as below that of most women.

Table 3. Percentage distribution of wives in planned families by self-rating on risk to own health in having another child, by self-appraisal on general health since marriage.[1]

Risk to Wife's Health in Having Another Child	Wife's Health Since Marriage				
	Total	Poor or Fair	Good	Very Good	Excellent
Number of Couples	608	106	136	213	153
Total	100.0	100.0	100.0	100.1	99.9
Very Much More Than Most Women	5.1	6.6	6.6	5.2	2.6
Much More Than Most Women	4.6	7.5	5.9	3.8	2.6
Somewhat More Than Most Women	21.1	43.4	22.1	15.5	12.4
About Average	61.2	42.5	62.5	66.2	66.0
Somewhat Less Than Most Women	2.1	0.0	0.0	3.3	3.9
Much Less Than Most Women	5.9	0.0	2.9	6.1	12.4

[1] For childless couples the data relate to health risk in having "a child" rather than "another child."

[9] To some extent this may be due to differences in number and labeling of detailed ratings (*see* Appendix 1).

As expected, the appraisals on health risk incurred in having another child are related to actual health status. Table 3 presents data on this relationship for the wives in "planned families." The total proportion of wives appraising their health risk as above average is about 58 per cent for the wives rating their general health as "poor" or "fair," 35 per cent for those of "good health," 25 per cent for those of "very good" health, and 18 per cent for those of "excellent health." Conversely, the proportion appraising their health risk as below average ranges from none at all for those of "poor or fair" health to 16 per cent for those rating their health as "excellent."[10]

Relation of Health to Fertility-Planning Status. The pro-

[10] The Pearsonian coefficients of correlation give some indication of the extent to which various items considered in this analysis are related. They are shown below for selected pairs of items. Several cross-classifications are also given in detail in the tables.

Items Correlated	*Coefficient of Correlation*
Wife's General Health (Self-Appraisal) and	
Wife's pep and energy (rating by self)	+.31
" " " " (rating by spouse)	+.21
" " " " (rating by interviewer)	+.38
Risk to wife's health by another child (wife)	−.34
" " " " " " " (husband)	−.31
Extent couple discouraged from having more children by wife's poor health (rating by wife)	−.50
Extent couple discouraged from having more children by wife's poor health (rating by husband)	−.37
Husband's General Health (Self-Appraisal) and	
Husband's pep and energy (rating by self)	+.17
" " " " (rating by spouse)	+.15
" " " " (rating by interviewer)	+.35
Ratings of Wives and Husbands on Same Items:	
Pep and energy of wife	+.27
" " " " husband	+.26
Risk to wife's health by another child	+.53
Extent couple discouraged from having more children by wife's poor health	+.48
Other:	
Pep and energy of wife (interviewer-self)	+.36
" " " " " (interviewer-spouse)	+.27
Pep and energy of husband (interviewer-self)	+.25
" " " " " (interviewer-spouse)	+.29
Wife's self-rating pep and energy and risk to health in having another child	−.16
Wife's rating on extent couple discouraged from having more children by wife's poor health and risk to wife's health by another child	+.54

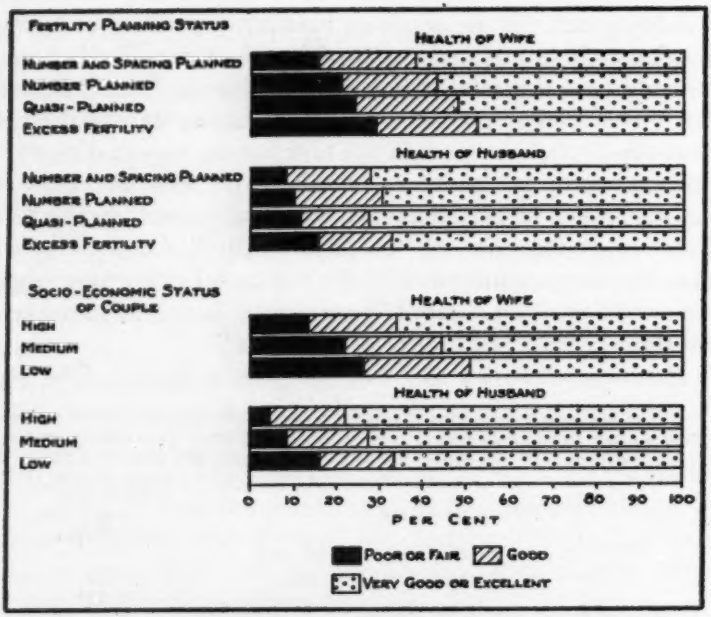

Fig. 1. Percentage distribution of wives and husbands by self-appraisal of health since marriage, according to fertility-planning and socio-economic status of the couple (*see* Table 1).

portion of wives and husbands reporting very good or excellent health decreases definitely with fertility-planning status and also with socio-economic status of the couple. (Figure 1 and Table 1.)[11]

When socio-economic status is held constant, the tendency for high ratings on health of wife to be associated with high fertility-planning status persists only within the groups of "medium" and "low" socio-economic status. To a less extent this type of persistence holds with respect to ratings of the hus-

[11] The index of socio-economic status of the couple is based upon ratings of the couple with respect to average annual earnings of the husband since marriage, monthly rental value of the home at interview, net worth of the couple, husband's longest occupation since marriage, purchase price of car, education of the husband and wife, and score on Chapin's Social Status Scale. For further description, *see* Kiser, Clyde V. and Whelpton, P. K.: Social and Psychological Factors Affecting Fertility. IX. Fertility Planning and Fertility Rates by Socio-Economic Status. The Milbank Memorial Fund *Quarterly*, April, 1949, xxvii, No. 2, pp. 214, 216, 244 (Reprint pp. 385, 387, 415).

Table 4. Percentage distribution by self-appraisal of health of wife and husband for couples of given fertility-planning and socio-economic status.

Self-Appraisal of Health	Wife				Husband			
	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
	HIGH SOCIO-ECONOMIC STATUS							
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Poor or Fair	13.8	18.2	10.9	11.1	5.5	6.1	3.6	0.0
Good	22.9	12.1	29.1	3.7	13.8	9.1	29.1	18.5
Very Good or Excellent	63.3	69.7	60.0	85.2	80.7	84.8	67.3	81.5
	MEDIUM SOCIO-ECONOMIC STATUS							
Total	100.0	100.0	99.9	100.0	100.0	99.9	100.0	100.1
Poor or Fair	14.7	20.7	24.7	29.8	6.8	5.7	10.6	10.6
Good	26.0	21.8	23.7	13.5	24.3	19.5	15.2	13.5
Very Good or Excellent	59.3	57.5	51.5	56.7	68.9	74.7	74.2	76.0
	LOW SOCIO-ECONOMIC STATUS							
Total	100.0	100.1	100.0	100.0	100.0	100.0	99.9	100.0
Poor or Fair	18.8	22.4	26.9	30.3	12.8	16.5	14.4	19.0
Good	17.1	25.9	22.4	29.5	17.1	24.7	12.4	18.1
Very Good or Excellent	64.1	51.8	50.7	40.2	70.1	58.8	73.1	62.9
	NUMBER OF COUPLES (BASES FOR ABOVE PERCENTAGES)							
High Socio-Economic Status	109	33	55	27	109	33	55	27
Medium Socio-Economic Status	177	87	198	104	177	87	198	104
Low Socio-Economic Status	117	85	201	251	117	85	201	248

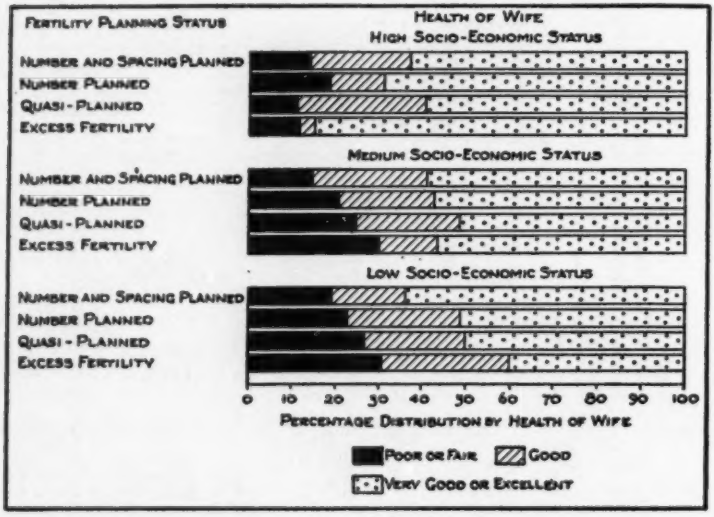

Fig. 2. Percentage distribution by self-appraisal of health of wife since marriage, for couples of given fertility-planning and socio-economic status (*see* Table 4).

band on his health (Figure 2 and Table 4). On the other hand, within each fertility-planning status, low ratings on health of wife and husband are associated with low socio-economic status.

Indirectly, the above data themselves fail to support that part of the hypothesis concerning the relation of health of wife and husband to effectiveness of contraceptive practice. More direct testing is afforded in Figure 3, based on Table 5, showing distributions by fertility-planning status within groupings by self-appraised health of the wife and husband. The results are again opposite those assumed in the hypothesis. The poorer the health of the wife, and to a less extent the poorer the health of the husband, the *smaller* is the proportion of the couples practicing contraception with sufficient effectiveness to be classified as "planned families." The proportion of "planned families" extends from about one-third among couples in which wives rated their own health as "poor" or "fair" to about one-half

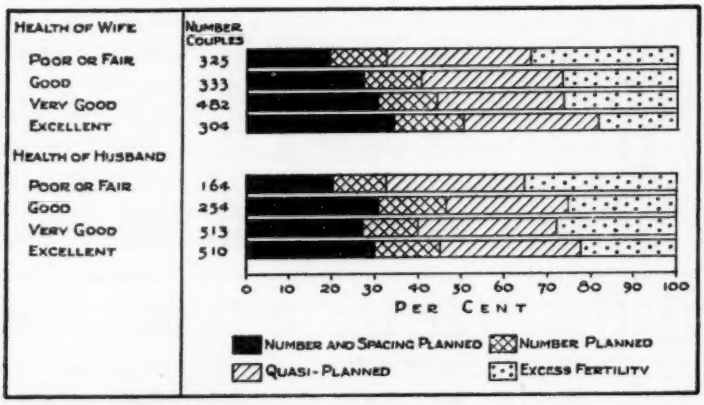

Fig. 3. Fertility-planning status by self-appraisal of health of wife and husband since marriage (*see* Table 5).

among couples in which wife's health was appraised as "excellent." On the basis of the husband's health, the proportion is again about one-third for the "poor or fair" group, but the remaining percentages are 47, 40, and 45 for the "good," "very good," and "excellent" health-of-husband categories.

Table 5. Fertility-planning status by self-appraisal of health of wife and husband.

Self-Appraisal of Health	Number	Per Cent Distribution by Planning Status				
		Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
All Couples	1,444	100	27.9	14.2	31.4	26.5
Wife						
Poor or Fair	325	100	19.4	13.2	33.5	33.8
Good	333	100	27.3	13.5	32.4	26.7
Very Good	482	100	30.1	14.1	29.3	26.6
Excellent	304	100	34.2	16.1	31.6	18.1
Husband						
Poor or Fair	164	100	20.1	12.8	31.7	35.4
Good	254	100	30.7	16.1	28.0	25.2
Very Good	513	100	27.1	12.9	32.0	28.1
Excellent	510	100	30.0	15.1	32.7	22.2

Table 6. Fertility-planning status by ratings of self, spouse, and interviewer on pep and energy of wife and husband.[1]

Rating on Pep and Energy	Pep and Energy of Wife					Pep and Energy of Husband				
	Per Cent Distribution by Fertility-Planning Status									
	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
All Couples	100	27.9	14.2	31.4	26.5	100	27.9	14.2	31.4	26.5
Rating By Self										
Very Little or Little	100	23.7	18.4	25.0	32.9	•	•	•	•	•
Somewhat Less Than Average	100	29.4	18.3	28.6	23.8	100	34.4	6.7	32.2	26.7
About Average	100	24.5	9.3	36.1	30.0	100	24.9	13.8	32.8	28.5
Somewhat More Than Average	100	35.3	17.6	26.2	20.8	100	29.2	14.6	34.9	21.4
Much	100	35.7	9.3	29.3	25.7	100	34.8	13.5	31.2	20.6
Very Much	100	27.5	35.1	22.1	15.3	100	31.0	20.1	21.7	27.2
Rating By Spouse										
Very Little or Little	100	25.0	13.6	34.1	27.3	100	17.1	5.7	20.0	57.1
Somewhat Less Than Average	100	29.5	17.4	31.8	21.2	100	36.0	16.0	28.0	20.0
About Average	100	26.8	13.1	30.8	29.3	100	26.4	12.6	31.9	29.1
Somewhat More Than Average	100	31.7	10.7	32.5	25.1	100	33.6	12.5	31.3	22.7
Much	100	28.0	16.0	34.0	22.0	100	27.0	14.6	36.0	22.5
Very Much	100	25.0	23.3	28.4	23.3	100	25.0	27.2	27.9	19.9
Rating By Interviewer										
Worn Out—No Reserves of Energy	100	8.0	20.0	32.0	40.0	100	17.9	7.1	14.3	60.7
Some Pep and Energy	100	31.5	10.0	28.0	30.4	100	24.6	7.9	33.3	34.2
Average Pep and Energy	100	26.5	11.5	34.7	27.3	100	26.5	10.7	32.5	30.3
Much Pep and Energy	100	30.0	19.3	29.0	21.7	100	30.0	18.9	31.4	19.7
Unlimited Pep and Energy	100	33.8	18.2	31.2	16.9	100	33.3	18.2	28.3	20.2

[1] For numerical distributions, *see* Appendix I.
• Percentages not computed for base less than 20.

It will be noted that in both cases the patterns of relationship between health and fertility-planning status are set in large part by differential proportions in the two extreme fertility-planning groups, "number and spacing planned" and "excess fertility." For instance, in the classifications by wife's health the proportion of "number and spacing planned" couples extends from 19 per cent for the "poor or fair" group to 34 per cent for the "excellent" group. The proportion of "excess fertility" couples is 34 per cent for the "poor or fair" group and 18 per cent for the group with wives rating their health as excellent. The proportion of couples in the "number planned" and "quasi-planned" groups differ little by health status of the wife or husband.

The relationships that exist between fertility-planning status and "pep and energy" of the wife and husband (as rated by self, spouse, and interviewer) also are direct and hence run counter to the hypothesis. This type of relation is especially prominent in the classification by interviewer's rating. As indicated in Table 6 (lowest sections), the proportion of "planned families" ("number and spacing planned" and "number planned" combined) increases and the proportion of "excess fertility" families decreases rather sharply with rise of interviewer's rating on pep and energy of either the wife or husband. In the classifications by rating by self or spouse the direct relation of fertility-planning status to "pep and energy" is exhibited in the comparison of extreme groups but it does not extend throughout the groups intermediate with respect to rating on "pep and energy."

Even less relation is found between fertility-planning status of the couple and the putative risk to wife's health in having another child (Table 7). In the joint classification by statement of wife and husband (Table 8) the proportion of "planned families" is about 44 per cent for the group in which both wife and husband indicated above-average risk to wife's health. It is 43 per cent for the group in which both stated "about average" and 23 per cent for the group in which both

Table 7. Fertility-planning status by risk to wife's health in having another child according to wife's opinion, husband's opinion, wife's rating of husband's opinion, and husband's rating of wife's opinion.[1]

Risk to Wife's Health in Having Another Child	Per Cent Distribution by Fertility-Planning Status									
	Total[2]	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Total[2]	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
All Couples	100	27.9	14.2	31.4	26.5	100	27.9	14.2	31.4	26.5
	Wife's Opinion					Husband's Opinion				
Very Much More Than Most Women	100	27.5	6.6	35.2	30.8	100	30.6	13.7	30.6	25.0
Much More Than Most Women	100	30.4	10.1	27.5	31.9	100	32.3	12.1	25.3	30.3
Somewhat More Than Most Women	100	33.9	16.5	30.7	18.9	100	30.5	15.4	29.9	24.2
About Average	100	27.1	14.9	31.2	26.7	100	28.2	14.6	32.9	24.3
Somewhat Less Than Most Women	100	12.2	14.3	44.9	28.6	100	20.5	11.1	35.0	33.3
Much Less Than Most Women	100	25.8	11.3	27.8	35.1	100	11.3	13.2	24.5	50.9
	Wife's Rating of Husband's Opinion					Husband's Rating of Wife's Opinion				
Very Much More Than Most Women	100	36.8	11.8	25.0	26.3	100	31.9	9.7	28.3	30.1
Much More Than Most Women	100	27.6	13.3	28.6	30.6	100	28.9	13.3	34.4	23.3
Somewhat More Than Most Women	100	35.5	16.6	28.4	19.6	100	27.9	15.1	33.8	23.3
About Average	100	24.5	13.2	33.2	29.1	100	28.1	13.6	31.8	26.5
Somewhat Less Than Most Women	100	24.6	23.1	35.4	16.9	100	32.7	11.8	33.6	21.8
Much Less Than Most Women	100	29.4	10.3	32.4	27.9	100	14.0	26.0	23.0	37.0

[1] For childless couples the data relate to health risk in having "a child" rather than "another child."
[2] The numbers on which percentage distributions are based are given in the left section of Table 2.

Table 8. Fertility-planning status by wife's and husband's opinion regarding risk to wife's health in having another child.[1]

Risk to Wife's Health in Having Another Child		Number of Couples	Per Cent Distribution by Fertility-Planning Status				
			Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
Opinion of							
Wife	*Husband*						
More Than Most Women	More Than Most Women	297	100	30.3	13.5	32.7	23.6
More Than Most Women	About Average	101	100	36.6	10.9	26.7	25.7
About Average	More Than Most Women	208	100	30.8	15.9	24.5	28.8
About Average	About Average	575	100	28.0	14.8	34.1	23.1
About Average	Less Than Most Women	101	100	14.9	13.9	28.7	42.6
Less Than Most Women	About Average	77	100	18.2	18.2	32.5	31.2
Less Than Most Women	Less Than Most Women	53	100	18.9	3.8	37.7	39.6

[1] For childless couples the data relate to health risk in having "a child" rather than "another child."

husband and wife indicated that the risk to wife's health was below average. However, whereas the first two percentages are based upon 297 and 575 cases, the last one is based upon 53 and hence lends little support to the hypothesis.

It should also be noted that the direct relation of fertility-planning status to health of wife is greatly reduced when the analysis is restricted to groups of given index of socio-economic status (Table 9). In fact, within the top socio-economic group there is the suggestion of a reversal. It may be that among such couples there is some tendency for health to be inversely related to fertility-planning status. The numbers are too small to afford assurance on this point. Whatever this situation may be, it is clear that much of the observed direct relation of fertility-planning status to health appraisals of the wife or hus-

Table 9. Fertility-planning status in subdivisions by wife's self-appraisal of health and socio-economic status of the couple.

Self-Appraisal Health of Wife	Number	Per Cent Distribution by Planning Status				
		Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
	High-Socio-Economic Status					
Total	224	100	48.7	14.7	24.6	12.1
Poor or Fair	30	100	50.0	20.0	20.0	10.0
Good	46	100	54.3	8.7	34.8	2.2
Very Good or Excellent	148	100	46.6	15.5	22.3	15.5
	Medium Socio-Economic Status					
Total	566	100	31.3	15.4	35.0	18.4
Poor or Fair	124	100	21.0	14.5	39.5	25.0
Good	126	100	36.5	15.1	37.3	11.1
Very Good or Excellent	316	100	33.2	15.8	32.3	18.7
	Low Socio-Economic Status					
Total	654	100	17.9	13.0	30.7	38.4
Poor or Fair	171	100	12.9	11.1	31.6	44.4
Good	161	100	12.4	13.7	28.0	46.0
Very Good or Excellent	322	100	23.3	13.7	31.7	31.4

band is associated with the direct relation of socio-economic status to both health and fertility-planning status.

Fertility by Health of Wife and Husband. As already noted, the last part of the hypothesis under consideration states that "the poorer the health of the wife and/or husband the smaller the planned family."

In the first place, available data of the opinion-poll type may be of interest. In addition to the questions previously listed, wives and husbands in the Study were asked to indicate which of a list of reasons were of first, second, and third importance in discouraging the couple from having children or more children. "Poor health of self" was checked by 17 per cent of the wives as the reason of first importance, by 12 per cent as reason of second importance, and by 9 per cent as the reason of third importance. Correspondingly, "poor health of spouse" was indicated by 20 per cent of the husbands as the reason of first importance, by 10 per cent as the reason of second importance, and by 8 per cent as the reason of third importance. As one might expect, the poor health of the husband was rarely given as a factor of importance. Thus, "poor health of self" was given as the reason of first importance by only 1 per cent of the husbands, as the second reason by only 4 per cent, and as the third reason by only 3.5 per cent. "Poor health of spouse" was checked by only 2 per cent of the wives as the reason of first importance,[12] by 4 per cent as the reason of second importance, and by 3 per cent as the reason of third importance. Although the above data relate to all couples, the proportion of wives and husbands indicating poor health of self or spouse as the chief reason for not having a child or more children has been found to differ little by fertility-planning status.

As previously stated, all wives and husbands in the Study were asked to indicate on five-point scales the *extent* to which

[12] For a complete distribution of reasons of first, second, and third importance, *see* Kiser, Clyde V. and Whelpton, P. K.: Social and Psychological Factors Affecting Fertility. XI. The Interrelation of Fertility, Fertility Planning, and Feeling of Economic Security. The Milbank Memorial Fund *Quarterly*, January, 1951, XXIX, No. 1, p. 73.

they were discouraged from having a child or more children by the poor health of self and poor health of spouse. The replies again attest to the relative unimportance of health as a factor in fertility of the group. (Table 10.) Almost half (47 per cent) of the wives and over half (51 per cent) of the husbands stated that poor health of the wife had discouraged the couple "very little or not at all" from having a child or more children. Approximately 80 per cent of the husbands gave this reply regarding their own health and a corresponding 74 per cent of the wives gave it with respect to health of spouse.

At the other end of the scale, about 12 per cent of all wives and 9 per cent of all husbands stated that the couple had been "very much" discouraged from having a child or more children because of the poor health of the wife. The proportion replying either "very much" or "much" was about 20 per cent for the wives and 17.5 per cent for the husbands. Only about 5 per cent of the wives and 4 per cent of the husbands gave these replies with respect to health of the husband as a deterrent to fertility.

As one would expect, the extent of discouragement from

Table 10. Percentage distribution by extent to which poor health of wife and husband discouraged the couple from having more children, by statement of self and spouse.[1]

Extent of Discouragement	Couple Discouraged From Having More Children by Poor Health of			
	Wife		Husband	
	Statement by Self	Statement by Spouse	Statement by Self	Statement by Spouse
Total	100.0	100.1	99.9	100.0
Very Much	11.8	9.3	1.8	3.7
Much	8.5	8.2	1.8	1.5
Some	18.3	17.9	6.2	6.0
Little	14.7	13.7	10.2	14.4
Very Little or Not at All	46.7	51.0	79.9	74.4

[1] The percentage base is 1,444 in each column except the last, which is 1,442. For childless couples the data relate to discouragement from having "children" rather than "more children."

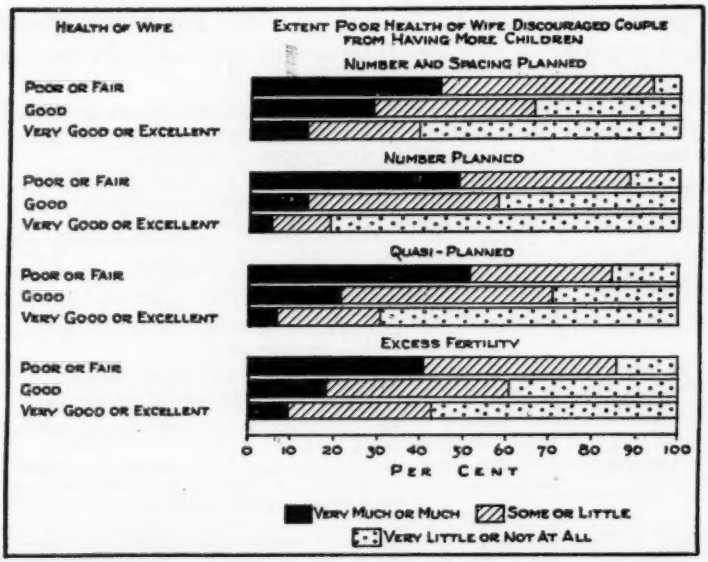

Fig. 4. Percentage distribution by wife's statement on extent to which her poor health discouraged the couple from having more children, by fertility-planning status of the couple and wife's appraisal of her health since marriage (*see* Table 11).

having more children because of poor health is related both to actual health status and to number of children already born. Thus among all couples, the proportion of wives stating that their own poor health had discouraged the couple "very much or much" from having more children is 46 per cent for those rating their health as "poor or fair," 21 per cent for those with "good" health, and 9 per cent for those with "excellent" health. As indicated in Figure 4 and Table 11, this pattern of relationship holds within each fertility-planning group.

The proportion of wives reporting that they were "very much or much" discouraged from having more children because of their own poor health tends to increase somewhat with number of children but not to a striking degree. (Table 12.)[13] The

[13] Among "planned families," the proportion giving the above replies is about 15 per cent for those with no live births, 24 per cent for those with one, 20 per cent for those with two, 17 per cent for those with three, and 26 per cent for those with four or more.

proportions of *husbands* stating that the couple was "very much or much" discouraged from having more children because

Table 11. Percentage distribution by wife's statement on extent to which her poor health discouraged couple from having more children, by wife's self-appraisal of health and by fertility-planning status of the couple.[1]

Self-Appraisal Health of Wife	Number of Couples	Per Cent Distribution by Extent of Discouragement			
		Total	Very Much or Much	Some or Little	Very Little or Not at All
	ALL COUPLES				
Total	1,444	100	20.3	33.0	46.7
Poor or Fair	325	100	46.2	40.9	12.9
Good	333	100	21.3	43.5	35.1
Very Good or Excellent	786	100	9.2	25.2	65.6
	NUMBER AND SPACING PLANNED				
Total	403	100	21.6	32.3	46.2
Poor or Fair	63	100	44.4	49.2	6.3
Good	91	100	28.6	37.4	34.1
Very Good or Excellent	249	100	13.3	26.1	60.6
	NUMBER PLANNED				
Total	205	100	16.1	25.9	58.0
Poor or Fair	43	100	48.8	39.5	11.6
Good	45	100	13.3	44.4	42.2
Very Good or Excellent	117	100	5.1	13.7	81.2
	QUASI-PLANNED				
Total	454	100	20.9	31.9	47.1
Poor or Fair	109	100	51.4	33.0	15.6
Good	108	100	21.3	49.1	29.6
Very Good or Excellent	237	100	6.8	23.6	69.6
	EXCESS FERTILITY				
Total	382	100	20.4	38.7	40.8
Poor or Fair	110	100	40.9	44.5	14.5
Good	89	100	18.0	42.7	39.3
Very Good or Excellent	183	100	9.3	33.3	57.4

[1] For childless couples the data relate to discouragement from having "children" rather than "more children."

of poor health of the wife or self showed little systematic variation by number of children.[14]

Although data of the above type are of interest in indicating the extent to which respondents *said* that poor health of self or spouse discouraged them from having more children, a more rigorous testing of the hypothesis is afforded by data relating to actual fertility rates by various measures of health of the wife and husband. Figure 5 presents fertility rates by self-ratings of the general health of the wife and husband within each of the four broad fertility-planning groups. Within no fertility-planning group, including the "number and spacing

Table 12. Extent to which poor health of self discouraged wife from having more children, by number of live births, for all couples and planned families.[1]

Extent of Discouragement of Wife	Number of Live Births					
	Total	0	1	2	3	4+
	All couples					
Number of Couples	1,444	135	365	540	234	170
Total	100.0	100.0	100.0	100.0	100.0	100.0
Very Much	11.8	6.7	11.0	12.0	14.1	13.5
Much	8.5	7.4	14.5	6.9	4.3	7.6
Some	18.3	16.3	19.7	17.6	16.7	21.2
Little	14.7	22.2	12.9	13.1	16.2	15.3
Very Little or Not at All	46.7	47.4	41.9	50.4	48.7	42.4
	Planned families					
Number of Couples	608	130	164	238	53	23
Total	100.0	100.0	99.9	100.0	100.0	99.9
Very Much	11.3	6.9	10.4	14.3	11.3	13.0
Much	8.4	7.7	13.4	5.5	5.7	13.0
Some	18.6	16.2	21.3	15.5	18.9	43.5
Little	11.5	22.3	8.5	8.8	11.3	0.0
Very Little or Not at All	50.2	46.9	46.3	55.9	52.8	30.4

[1] For childless couples the data relate to discouragement from having "children" rather than "more children."

[14] To some extent the data suggest an increase with lowering of socio-economic status in the proportion of wives or husbands stating that the couple was discouraged "very much" from having more children because of poor health of the wife. On the basis of statement by wife the proportions are 8.9, 10.4, and 13.9 for couples of high, medium, and low socio-economic status, respectively. On the basis of husband's statement the proportions are 0.0, 1.9, and 2.3, respectively.

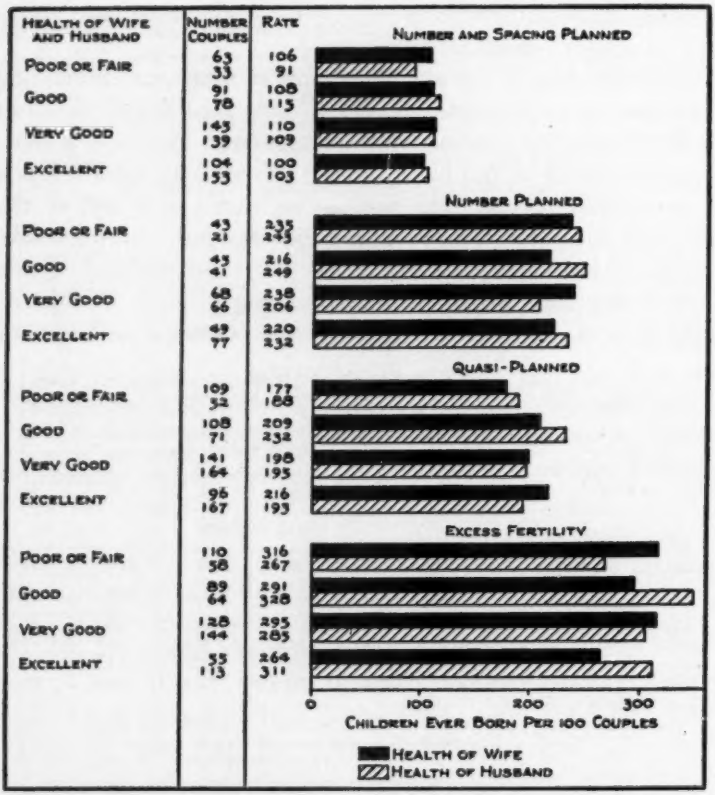

Fig. 5. Fertility rates by fertility-planning status and self-appraisal of health of wife and husband since marriage.

planned," is there any systematic relation of fertility to self-ratings of wives or husbands on their general health since marriage. It is true that within the "quasi-planned" group the variations in fertility rates by wife's self-appraisals of health conform to some extent with those assumed in the hypothesis. However, the hypothesis relates to "planned families" and the data for neither subgroup of these support the hypothesis.

In Figure 6 the data are shown for the total group of planned families subdivided into three socio-economic groups. No con-

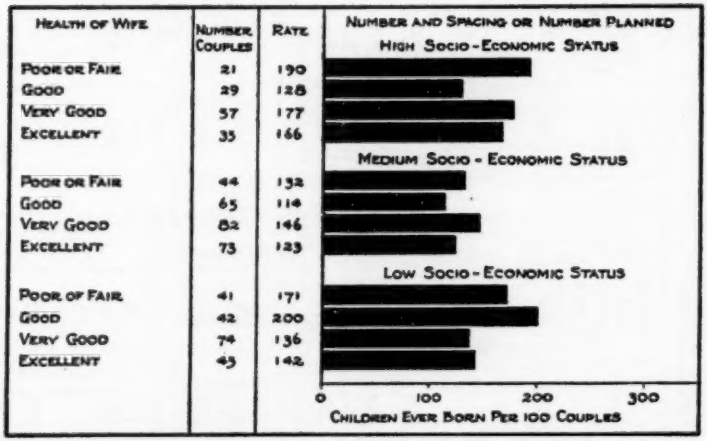

Fig. 6. Fertility rates of "planned families" cross-classified by socio-economic status and wife's appraisal of her health since marriage.

sistent relationship between health of wife and fertility is seen within groups of either "high" or "medium" socio-economic status. Among "planned families" of low socio-economic status, fertility rates are rather conspicuously lower for wives rating their own health as "very good" or "excellent" than for those rating their health status since marriage as only "good," "fair," and "poor." These rates are based upon small numbers but the relationships observed probably reflect the bearing of fertilty on health appraisals rather than the bearing of health on fertility.

Little systematic relation is found between fertility and "pep and energy" of the wife or husband as rated by self or spouse. Among the six sets of data shown in Table 13, only the interviewer's rating concerning fertility in relation to "pep and energy" *of the husband* clearly supports the hypothesis. In this instance (lower section of Table 13), the fertility rates of "number and spacing planned" couples increase sharply with rising "pep and energy." To a less extent a similar situation is found by interviewer's rating of the wife. It will be noted, however, that among the "number and spacing planned" couples

Table 13. Number of children ever born per 100 couples, by fertility-planning status and ratings of self, spouse, and interviewer on pep and energy of wife and husband.[1]

Rating on Pep and Energy	Pep and Energy of Wife					Pep and Energy of Husband				
	Fertility Rates by Fertility-Planning Status									
	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
All Couples	203	106	228	199	296	203	106	228	199	296
Rating By Self										
Very Little or Little Somewhat Less Than Average	193	105	222	162	293	197	125	•	210	235
About Average	215	120	237	205	297	209	108	215	201	303
Somewhat More Than Average	182	91	226	203	274	192	102	251	185	287
Much	189	90	•	212	283	196	92	•	218	331
Very Much	202	97	222	190	365	205	109	238	195	298
Rating By Spouse										
Very Little or Little Somewhat Less Than Average	216	118	234	204	343	201	118	•	168	283
About Average	205	105	228	200	293	212	113	222	204	305
Somewhat More Than Average	188	107	255	183	268	187	101	238	193	279
Much	201	117	204	216	282	187	81	208	209	265
Very Much	207	83	215	203	337	208	103	241	189	322
Rating By Interviewer										
Worn Out Some	223	111	243	191	341	256	76	•	243	345
Average	196	96	222	201	276	196	97	214	196	275
Much	196	107	229	210	270	199	116	230	193	305
Unlimited	190	146	•	162	•	202	139	•	200	300

[1] For numbers on which rates are based, *see* Appendix I.
• Rate not computed for base less than 20.

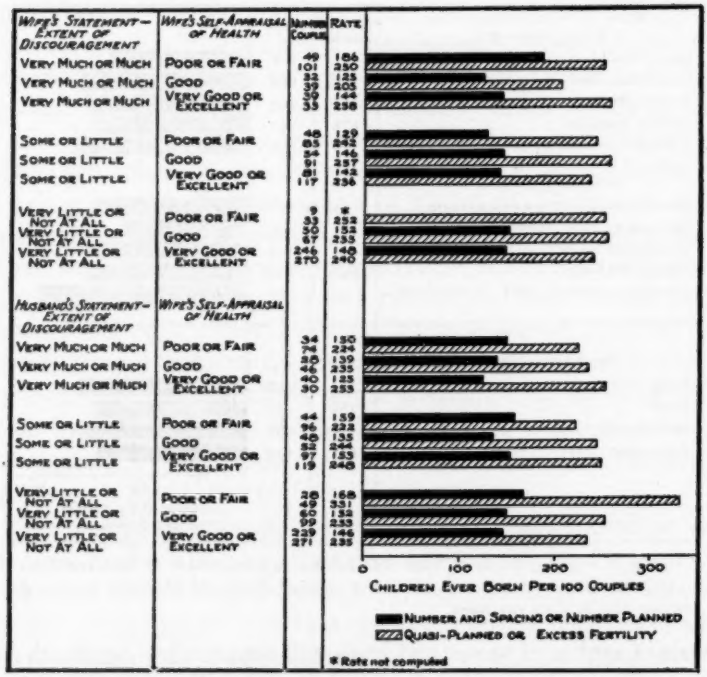

Fig. 7. Fertility rates of "planned families" and remaining couples cross-classified by wife's appraisal of her health since marriage and statement of the wife and husband on extent to which poor health of wife discouraged the couple from having more children.

in each of the four types of classification by rating of self or spouse, the opposite type of relation is exhibited to the extent that the fertility rate is lower for the class of most than of least "pep and energy."

Fertility rates are also presented in Figure 7 for cross-classifications of the "planned families," and remaining couples, by health ratings for the wife and extent to which the couple was discouraged from having more children because of the poor health of the wife.[15] The cross-classifications are shown on the

[15] Among "number and spacing planned" couples classified by statement of the wife on extent of discouragement from having more children because of poor health of the wife (regardless of health status), the fertility rates are directly related to

(Continued on page 358)

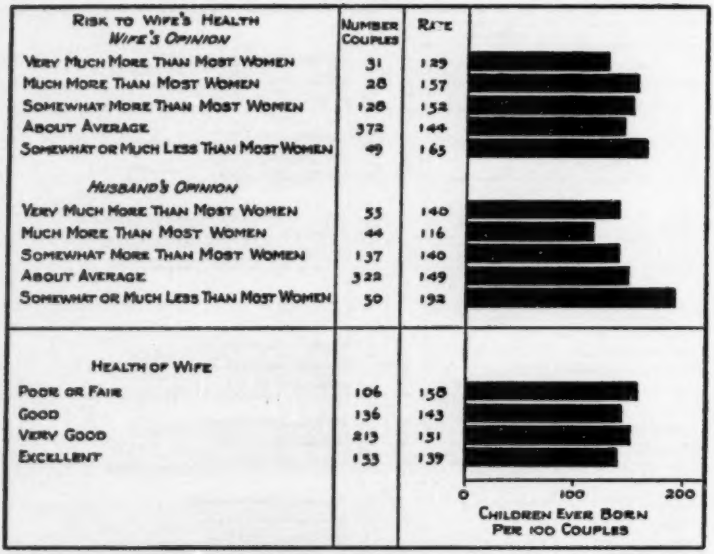

Fig. 8. Fertility rates of "planned families" by statement of wife and husband on risk to wife's health in having another child, and by wife's appraisal of her health since marriage.

basis of replies of wives and husbands separately. Again, there is no systematic pattern of variations in fertility rates. It is interesting to note, however, that in the classification of planned families by wife's statements on health and extent of discouragement, the fertility rate is highest (186) for the group "discouraged very much or much—health poor or fair." The fer-

degree of discouragement. However, this may simply reflect a selective tendency for statements on extent of discouragement to be related to number of children the wife has. The rates are as follows by statement of wife and husband.

Extent of Discouragement	Statement by			
	Wife	Husband	Wife	Husband
	Number Couples		Children Ever Born Per 100 Couples	
Very Much or Much	87	70	128	106
Some	75	71	117	86
Little	55	53	80	115
Very Little or Not at All	186	209	100	111

tility rate is only 148 for the group "discouraged very little or not at all—health excellent or very good." However, the remaining rates range from 125 to 152 and the former is for the group "discouraged very much or much—health of wife good."

Fertility rates among "planned families" by replies of wives and husbands to the question regarding risk to wife's health in having another child are shown in Figure 8. These data partially support the hypothesis. In the classification by husband's opinion, the fertility rate is 140 for the "very much more [risk] than average" group and 116 for the "much more than average" group. From the latter point, however, the fertility rates increase consistently with lowering of risk to wife's health and support the hypothesis rather strikingly. In the classification by wife's opinion, the fertility rates for the two extreme groups support the hypothesis but those for the intermediate groups run counter to it.[16]

For comparison, fertility rates by wife's self-appraisals on general health are also shown for the consolidated group of "planned families" in Figure 8. These run from 158 for the "poor or fair" group to 139 for the "excellent" group. Thus the fertility positions of the extreme groups in the classification by general health appraisals are opposite those by opinions regarding risk to wife's health in having another child. In view of this

[16] The joint classification by reply of wife and husband in "planned families" to the question regarding risk to wife's health in having another child yields the following results:

Risk to Wife's Health		Number Couples	Live Births Per 100 Couples
Wife	Husband		
More Than Average	More Than Average	130	144
" " "	About Average	48	150
" " "	Less Than Average	9	*
About Average	More Than Average	97	119
" "	About Average	246	148
" "	Less Than Average	29	203
Less Than Average	More Than Average	9	*
" " "	About Average	28	164
" " "	Less Than Average	12	*

* Rate not computed.

apparent inconsistency the results based upon joint consideration of wife's self-appraisals on general health and health risk in having another child are of interest. In the first place it will be noted from Table 3 that within each health-appraisal group the replies regarding risk tend to pile up on "about average" and "somewhat more than most women." Thus among the 106 wives reporting "poor or fair" health only about 14 per cent stated that the health risk in having another child was "very much or much more than most women." The remaining couples were almost equally divided between the "somewhat more than most women" and "about average" groups. Among the 153 women with "excellent" health only 5 per cent replied that the health risk involved in having another child was "very much or much more than most women" and only 16 per cent replied "somewhat or much less than most women."

Several comments may be made regarding fertility rates in Table 14. In the first place it will be noted that the fertility

Table 14. Number of children ever born per 100 couples among planned families, by wife's self-appraisal of health and risk to health by having another child.

Wife's Self-Appraisal		Number Couples	Live Births Per 100 Couples
General Health	Risk to Health		
Total		608	148
Poor or Fair	More Than Most Women	61	180
Poor or Fair	About Average	45	129
Poor or Fair	Less Than Most Women	0	—
Good	More Than Most Women	47	128
Good	About Average	85	147
Good	Less Than Most Women	4	*
Very Good	More Than Most Women	52	138
Very Good	About Average	141	148
Very Good	Less Than Most Women	20	210
Excellent	More Than Most Women	27	137
Excellent	About Average	101	145
Excellent	Less Than Most Women	25	116

* Rate not computed.

rate is relatively high (180) for the group with wives reporting "poor or fair" health and more than average risk to health in having another child. It is lowest (116) for the group at the other extreme, health excellent—less than average risk. In the second place, within each health-status group except "poor or fair" the fertility rate is lower for the more than average risk than for the "average risk" group. In the third place, the conspicuously high rate for the wives reporting "poor or fair" health and more than average risk probably again illustrates a selective relationship corresponding to that assumed to underlie the high fertility rate (186) for the group "health poor or fair—discouraged much or very much" from having more children because of wife's poor health. In other words, the fact that a woman has had a comparatively large number of children may influence her self-rating on general health and risk to health involved in having another child.

Data on Illness. In addition to the self-appraisals of the type previously considered, wives and husbands were asked "What serious illnesses have you had? When?" The coding of these data has thus far been restricted to designations by "0" of wives and husbands who had been free of any illness. However, this has been done for each pregnancy interval on the basis of the dates afforded.

As noted in Table 15, the illness status of the wife prior to a given pregnancy apparently has little relation to the proportion of couples proceeding to have a subsequent pregnancy. Thus among couples having at least one pregnancy and with wife reporting no illness before the first pregnancy, 71 per cent eventually had a second pregnancy. The percentage was a little higher (76) for corresponding couples in which the wife reported an illness before the first pregnancy. Differences in the same direction and of about the same magnitude are found in the data concerning second and third pregnancies. A larger difference in the same direction is found with respect to proportions having a pregnancy after the fourth. The difference is in the opposite direction with respect to proportions having a

pregnancy after the fifth but these proportions are based upon numbers too small to yield trustworthy results. Within the limits of the data available for "planned families" the results are essentially similar to those described above for all couples in the Study.

Sickness of Husband in Relation to Unemployment. Unemployment histories of the husband since marriage provided for designations as to whether specific periods of unemployment had been due to sickness. In the coding, given durations of unemployment (including "no unemployment") were subdivided into the two groups "sick two months or more" and "sick under two months or not at all." Despite the inadequacy of these cat-

Table 15. Illness status of wife and husband prior to a given pregnancy in relation to proportion of couples having another pregnancy, for all couples, and planned families reporting pregnancies of given order.

Illness Status Preceding Given Pregnancy	All Couples		Planned Families	
	Number	Per Cent Having Another Pregnancy	Number	Per Cent Having Another Pregnancy
First Pregnancy				
No Illness	635	70.9	187[a]	49.7
One Illness or More	483	75.6	95[a]	54.7
Second Pregnancy				
No Illness	525	48.8	182	29.7
One Illness or More	489	53.2	162	36.4
Third Pregnancy				
No Illness	238	45.8	50	26.0
One Illness or More	278	50.0	63	39.7
Fourth Pregnancy				
No Illness	98	38.8	13	•
One Illness or More	150	46.7	25	•
Fifth Pregnancy				
No Illness	35	51.4	1	•
One Illness or More	73	42.5	7	•

• Per cent not computed.

[a] This "First Pregnancy" group consists only of "number and spacing planned" couples, since, by definition, the probability of having a second pregnancy is almost 100 per cent for the "number planned" couples.

egories for present purposes, it is of interest to note that among all "planned families" the fertility rate is approximately the same for those with husbands reporting two months or more of sickness (150) as for those reporting under two months of sickness or none at all (147). Among all couples the rates are 233 and 199, respectively, for the two groups regardless of unemployment. No consistent difference is found between the rate for couples with husbands sick "two months or more" and "under two months" within groups similar with respect to months of unemployment.

To summarize this section it may be stated that neither part of the hypothesis on the relation of health of wife and husband to fertility-planning status and size of planned family is supported by the limited data available. Moreover, the data suggest that whether or not poor health is conducive to family limitation, high fertility is associated with relatively poor health. There is, of course, little doubt that the hypothesis holds for families with specific types of illness. Downes has reported lower fertility of tuberculous families than of those in the general population of a rural area in New York State.[17] Probably many of us know of certain couples who refrain from having more children because the wife is tuberculous, has diabetes, or because she has had only Caesarean deliveries in the past.[18] However, this type of relation appears to be lost in a small sample of the general population in which such cases are relatively few and no distinction is made by type of illness.

Health of Children

The data concerning health of children are subject to limitations similar to those on health of wife and husband. They

[17] Downes, Jean: The Effect of Tuberculosis on the Size of Family. The Milbank Memorial Fund *Quarterly*, July, 1939, xvii, No. 3, pp. 274–287.

[18] Dorn's study of cancer in relation to marital status suggested that "the ameliorative effect of marriage upon health seems to be due to childbearing rather than to the fact of marriage itself, at least insofar as cancer is concerned. For both males and females, those who marry and have children are less likely to die from cancer than those who remain single, but those who marry and do not have children have the highest death rates."

See Dorn, Harold: Cancer and Marital Status. *Human Biology*, February, 1943, xv, No. 1, p. 78.

consist not of detailed histories of illnesses but of (a) mother's ratings of the health of each of her children "in infancy" (under 2 years of age) and "since infancy," (b) multiple-choice replies of parents in the Study concerning extent of discouragement from having another child because of poor health of the children, (c) deaths of children, and (d) proportions of wives and husbands giving "poor health of children" as the reason of first, second, and third importance for not having more children.

For obvious reasons the above-described data were not collected for childless couples so the analysis of the present hypothesis is restricted to 1,309 couples with at least one live birth. It should also be noted that, although the collected data included health ratings of each child, the coded data for these materials consist mainly of average ratings on health of all children in the family "in infancy" and "since infancy."[19]

Like the ratings on health of wife and husband, those on health of children tend to be high. The average ratings on the health of children "in infancy" are distributed as follows: "excellent," 48 per cent; "very good," 29 per cent; "good," 17 per cent; "fair," 4 per cent; and "poor," 2 per cent. Thus over three-fourths of the average ratings are "excellent or very good" and only 6 per cent are in the combined "poor or fair" category. With respect to health of children "since infancy," the proportions are "excellent," 37 per cent; "very good," 35 per cent; "good," 22 per cent; "fair," 5 per cent; and "poor," less than 1 per cent.[20] Only about 8 per cent of the fertile couples reported one or more deceased children. The data on stated impact of children's health on fertility are presented in a later section.

Fertility-Planning Status of Couples by Health Status of Children. As already indicated, the first part of the hypothesis

[19] The five categories extending from "excellent" to "poor" were numbered 1, 2, 3, 4, 5 on the original schedule. The averages of scores for more than one child were reconverted to appropriate qualitative categories in the present analysis. Although the coded data relate mainly to average ratings, they permit some differentiation on the basis of individual ratings.

[20] The numbers to which the percentages correspond are given in Table 16. Since the "poor" and "fair" categories are consolidated, it may be noted that there are 27 average ratings of "poor health in infancy" and 10 of "poor health since infancy."

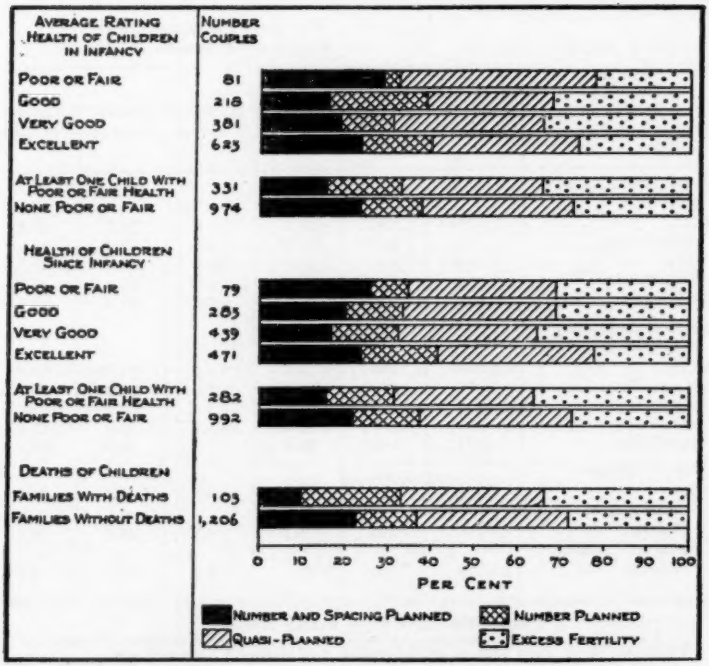

Fig. 9. Fertility-planning status of fertile couples by average rating of health of children in infancy and since infancy, by presence or absence of at least one child with a health rating of "poor or fair," and by deaths of children in family (*see* Table 16).

under consideration is: "The poorer the health of children, the higher the proportion of couples practicing contraception effectively. . . ." As indicated in Figure 9 and Table 16 no consistent relationship is found between fertility-planning status of the couple and average health ratings of children "in infancy" and "since infancy." However, certain selective factors are inherent in the use of average ratings, especially in data presented for all family sizes combined. Stated briefly, the extreme categories on the "average rating" scales are likely to be weighted unduly by one-child families. The average rating for two or more children in a family tends to be "poor" or "excellent" only if all children are so rated. The small families are

Average Rating	Number of Couples	Per Cent Distribution by Fertility-Planning Status				
		Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
Health of Children in Infancy						
Total	1,309[a]	100	21.2	15.4	34.4	29.1
Poor or Fair	81	100	28.4	3.7	45.7	22.2
Good	218	100	15.6	22.9	29.4	32.1
Very Good	381	100	18.6	12.3	34.4	34.6
Excellent	625	100	23.8	16.2	34.4	25.6
Health of Children Since Infancy						
Total	1,293[b]	100	20.2	15.5	34.8	29.5
Poor or Fair	79	100	25.3	8.9	34.2	31.6
Good	285	100	20.0	13.3	35.4	31.2
Very Good	439	100	16.6	15.7	32.3	35.3
Excellent	471	100	23.4	17.8	36.7	22.1
Deaths of Children						
Total	1,309	100	21.2	15.4	34.4	29.1
Families With Deaths	103	100	9.7	23.3	33.0	34.0
Families Without Deaths	1,206	100	22.1	14.7	34.5	28.7

[a] Includes four unknowns on average health rating.
[b] Includes 19 unknowns on average health rating. Excludes 16 couples whose children were infants at interview, i.e., under 2 years of age.

Table 16. Fertility-planning status of fertile couples by average rating of health of children in infancy and since infancy and by deaths of children.

more likely to be "number and spacing planned" than are large families and probably partly for this reason the proportion of such couples is higher in the "poor or fair" and "excellent" health-of-children categories than in the intermediate health-status groups. This type of bias is overcome in part in the analyses specific with reference to number of live births (Table 17).

With the above refinements, it is only for the two-child families that the data rather consistently indicate increasing proportions of "planned families" and especially increasing proportions of "number and spacing planned" families with rising health status of children "in infancy" and "since infancy."[21]

[21] The chi square of the proportions of "number and spacing planned" couples among two-child families, by health of children since infancy, is 7.46 (d.f. = 3), almost significant at the 5 per cent level.

Average Rating	Number of Couples	Per Cent Distribution by Fertility-Planning Status				
		Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
		ONE LIVE BIRTH				
Health of Children in Infancy						
Poor or Fair	54	100	42.6	0.0	50.0	7.4
Good	52	100	32.7	11.5	42.3	13.5
Very Good	93	100	48.4	0.0	34.4	17.2
Excellent	166	100	38.0	6.0	39.8	16.3
		TWO LIVE BIRTHS				
Poor or Fair	20	100	0.0	15.0	35.0	50.0
Good	96	100	15.6	30.2	25.0	29.2
Very Good	137	100	16.8	18.2	46.0	19.0
Excellent	284	100	26.1	24.3	36.6	13.0
		THREE LIVE BIRTHS				
Good	38	100	5.3	23.7	26.3	44.7
Very Good	85	100	1.2	16.5	29.4	52.9
Excellent	106	100	8.5	17.0	25.5	49.1
		ONE LIVE BIRTH				
Health of Children Since Infancy						
Poor or Fair	50	100	36.0	4.0	46.0	14.0
Good	86	100	40.7	4.7	40.7	14.0
Very Good	99	100	44.4	0.0	34.3	21.2
Excellent	117	100	34.2	8.5	45.3	12.0
		TWO LIVE BIRTHS				
Poor or Fair	21	100	9.5	9.5	14.3	66.7
Good	105	100	19.0	25.7	38.1	17.1
Very Good	179	100	12.8	23.5	41.9	21.8
Excellent	219	100	28.3	23.7	36.5	11.4
		THREE LIVE BIRTHS				
Good	60	100	3.3	6.7	33.3	56.7
Very Good	92	100	5.4	23.9	20.7	50.0
Excellent	72	100	5.6	18.1	30.6	45.8

Table 17. Fertility-planning status of fertile couples by average rating of health of children in infancy and since infancy and given number of live births reported by the couple.

It is also apparent that with the use of average ratings the

Table 18. Fertility-planning status of fertile couples by statement of wife and husband on extent to which poor health of children discouraged couple from having more children. Distributions by wife's statement also given separately for families reporting one,two, and three live births.

Extent of Discouragement	Number of Couples	Per Cent Distribution by Fertility-Planning Status				
		Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
Total	1,309	100	21.2	15.4	34.4	29.1
	ALL COUPLES					
Wife's Statement						
Very Much or Much	31	100	38.7	25.8	16.1	19.4
Some	78	100	15.4	19.2	25.6	39.7
Little	112	100	15.2	10.7	37.5	36.6
Very Little or Not at All	1,088	100	21.7	15.3	35.2	27.8
Husband's Statement						
Very Much or Much	26	100	19.2	26.9	34.6	19.2
Some	31	100	0.0	22.6	32.3	45.2
Little	114	100	15.8	17.5	32.5	34.2
Very Little or Not at All	1,138	100	22.3	14.7	34.6	28.4
	ONE LIVE BIRTH					
Wife's Statement						
Very Much, Much, Some	30	100	56.7	13.3	13.3	16.7
Little	33	100	45.5	0.0	36.4	18.2
Very Little or Not at All	302	100	38.4	4.0	43.4	14.2
	TWO LIVE BIRTHS					
Very Much, Much, Some	33	100	18.2	39.4	21.2	21.2
Little	41	100	4.9	9.8	61.0	24.4
Very Little or Not at All	466	100	22.3	23.4	36.3	18.0
	THREE LIVE BIRTHS					
Very Much, Much, Some	28	100	0.0	17.9	39.3	42.9
Little	22	100	0.0	22.7	18.2	59.1
Very Little or Not at All	184	100	6.5	16.8	26.1	50.5

intermediate groups are composed partly of couples with all children having intermediate ratings and partly of couples with children at opposite extremes on the health-rating scale. In view of this, the distributions by fertility-planning status are presented in Figure 9 for couples having and not having at least one child with a health rating of only "poor or fair." These distributions run counter to the hypothesis but they contain the bias that the chance expectancy of having at least one child of poor health is greater in large than in small families and it is known that the small families are more likely to be planned families. This also applies in the distributions by presence or absence of child mortality.

No systematic relation is found between fertility-planning status and extent of discouragement in having more children because of the wife's poor health (Table 18). Among one-child families, the proportion of "planned families" rises sharply with extent of discouragement (as stated by the wife) but the differences have been found to be not statistically significant as a result of small numbers in certain classes.

The previously described positive relation between fertility-planning status of the couple and health of children is consistent with the results found by health of wife and husband. Although in both cases the results are opposite those assumed in the hypotheses, they are perhaps reasonable in view of the direct relation of socio-economic status to both fertility-planning status and to health status of husband, wife, and children. Unfortunately, the sample is too small to permit an actual assessment of the *role* of socio-economic status in the direct relation of fertility-planning status to health status of children in families of given size.

Fertility in Relation to Health of Children. The hypothesis on this topic, as previously given, reads as follows: "The poorer the health of children . . . the smaller the planned families."

In the first place the relative unimportance of "poor health of children" as a deterrent to fertility of planned families in the Study may be judged from the fact that very few of the chil-

dren were rated by their mothers as having "poor" health. The same perspective is yielded by the fact that only 1.5 per cent of all mothers in the Study gave "poor health of children" as the main reason for not having more children, an additional 1 per cent gave this as the reason of second importance, and an-

Table 19. Distribution of fertile couples by statement of wife and husband on extent to which poor health of children discouraged couple from having more children, by average rating of health of children in infancy and since infancy.

Average Rating of Health of Children	Number of Couples	Per Cent Distribution by Extent of Discouragement				
		Total	Very Much or Much	Some	Little	Very Little or Not at All
		WIFE'S STATEMENT				
In Infancy						
Total	1,309[a]	100	2.4	6.0	8.6	83.1
Poor or Fair	81	100	4.9	19.8	8.6	66.7
Good	218	100	7.3	13.8	9.6	69.3
Very Good	381	100	2.6	4.2	13.4	79.8
Excellent	625	100	0.2	2.6	5.3	92.0
	HUSBAND'S STATEMENT					
Total	1,309[a]	100	2.0	2.4	8.7	86.9
Poor or Fair	81	100	1.2	2.5	6.2	90.1
Good	218	100	4.6	2.8	10.6	82.1
Very Good	381	100	2.1	2.4	11.0	84.5
Excellent	625	100	1.1	2.2	7.0	89.6
	WIFE'S STATEMENT					
Since Infancy						
Total	1,293[b]	100	2.4	6.0	8.7	82.9
Poor or Fair	79	100	8.9	27.8	10.1	53.2
Good	285	100	5.3	9.8	13.7	71.2
Very Good	439	100	1.4	3.9	10.9	83.8
Excellent	471	100	0.6	2.1	3.6	93.6
	HUSBAND'S STATEMENT					
Total	1,293[b]	100	2.0	2.4	8.8	86.8
Poor or Fair	79	100	7.6	1.3	2.5	88.6
Good	285	100	3.5	3.9	11.6	81.1
Very Good	439	100	1.4	3.6	10.9	84.1
Excellent	471	100	0.8	0.6	5.9	92.6

[a] Includes 4 unknowns on average health ratings.
[b] Includes 19 unknowns, excludes 16 couples whose children were infants at interview, i.e., under 2 years of age.

other 3 per cent as the reason of third importance. Thus only about 6 per cent of the mothers (and 4 per cent of the fathers) gave "poor health of children" as one of the three most important reasons for not having more children. The proportions are slightly higher (7 per cent for mothers and 5 per cent for fathers) with respect to "planned families" alone.

Likewise, only about 2 per cent of all mothers and fathers in the Study stated that they had been discouraged "very much or much" from having more children because of the poor health of their children. (Table 19.)[22] The proportions replying "very much or much" are related to health status of the children since infancy and to a less extent to health status of children in infancy.

Fertility rates by fertility-planning status of the couple and average rating on health of children in infancy are shown in the top section of Figure 10. Among "planned families" (number and spacing or number planned) and also among the "quasi-planned" families the parents of children with lowest average ratings of health in infancy exhibit the lowest fertility rate. Little confidence can be placed in the reliability of these rates, however, partly because they are based upon small numbers and partly because of the selective factors inherent in the use of average ratings on health of children in the family. As previously stated, it seems likely that groups with average ratings of "poor" and "excellent" may be unduly weighted with small families because all or almost all children in the family would need to have an extreme rating on health in order to have an extreme "average" rating for all children in the family.[23] Whatever may be the roles of statistical reliability and selection in the low fertility rates for the "poor or fair" group, the remaining rates do not increase with improvement of health status of children in infancy.

[22] Within "planned families" alone the corresponding proportions are 4 per cent for mothers and 2.5 per cent for fathers.

[23] The effect of this selection is dampened somewhat by the combination of the "poor" and "fair" categories on the one hand and by the large proportion of children of "excellent" health on the other.

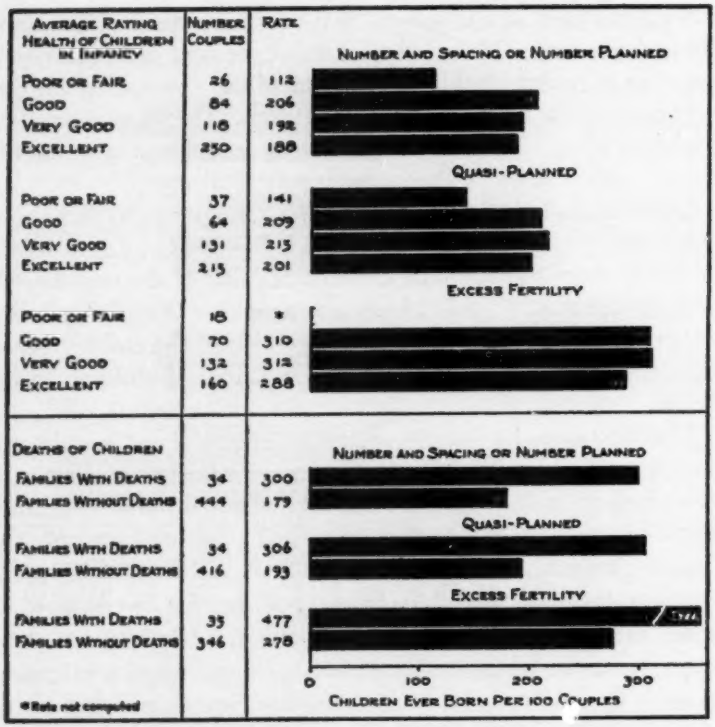

Fig. 10. Fertility rates of fertile couples by average rating of health of children in infancy, by deaths of children in the family, and by fertility-planning status of the couple.

Among the "number and spacing or number planned" couples there is a rather striking increase in fertility rates with rising average rating of health of children since infancy (Figure 11). Caution must be used in interpreting this as support of the hypothesis, however, because the limitations arising from small numbers and selective factors associated with average ratings also apply here.

On the assumption that deaths of children are frequently preceded by illness and that the average ratings of health of children tend to be lower in families reporting deaths of children than in those with all children living, fertility rates are

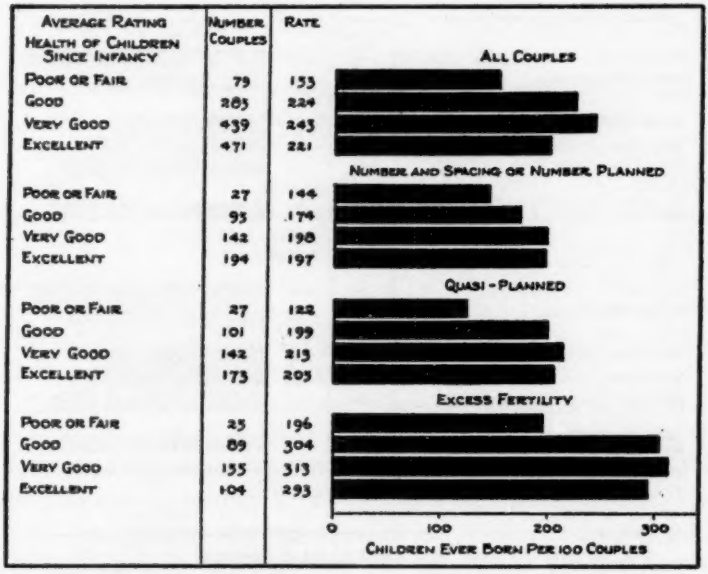

Fig. 11. Fertility rates of fertile couples by average rating of health of children since infancy and by fertility-planning status of the couple.

presented for the paired groups in Figure 10. In this instance the families with deaths of children are represented by small numbers. However, within each fertility-planning group the families with deaths are characterized by much higher fertility than those without deaths of children. As already stated, childless couples were excluded from the analysis so they have no part in accounting for the low fertility of the latter group. Nevertheless, a kindred bias is present in that the sheer chance expectancy of at least one child death in a family is higher in large than in small families. It is also possible that among the "planned families" in which child mortality occurs, the high fertility rate is to some extent due to efforts at replacement of the lost children.[24] The factor of replacement will be considered in a later study.

[24] In the "excess fertility" group the higher fertility of families with deaths probably reflects the ordinary association of high fertility, high infant mortality, and low economic status.

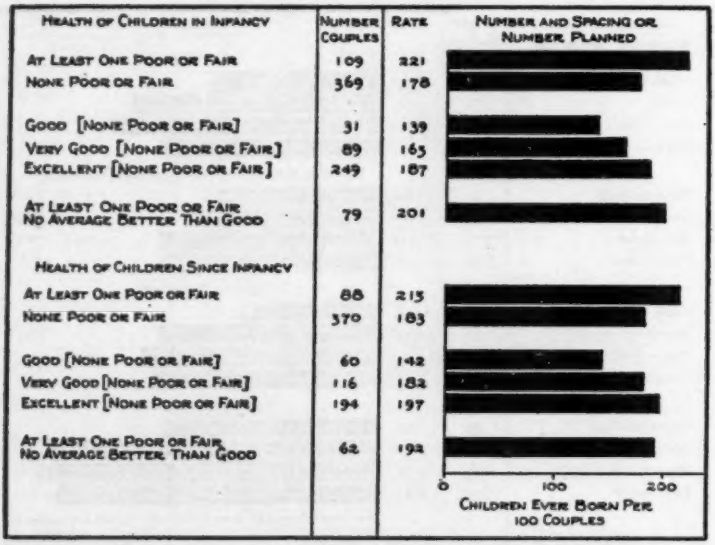

Fig. 12. Fertility rates of fertile couples of "planned family" status subdivided by joint consideration of average rating of health of children and presence or absence of at least one child with a health rating of "poor or fair."

The classifications in Figure 12 by whether the mother rated the health of at least one child as "poor or fair" represent another attempt to circumvent the limitations imposed by average ratings on health of children. They are restricted to "planned families." First of all it will be noted that families with at least one child rated as "poor or fair" in health during infancy or since infancy are more fertile than those with no children with health rating as low as this. As in the classifications by presence or absence of deaths, part of this is probably due to greater chance expectancy of finding one child of relatively poor health in large than in small families.

Of possibly more interest is the subdivision in Figure 12 of the families with no children rated as low as "poor or fair" *in infancy* (top panel) and since infancy (lower panel). Within these subdivisions, fertility rates vary by average health rating in a manner that supports the hypothesis. Thus in the classification by health during infancy, the fertility rates extend from

139 for the parents of children with average ratings of "good" health to 187 for the "excellent" group. However, the fertility rate is still higher for couples with at least one child rated as "poor or fair" and with none rated better than "good."

Owing to heavy concentration of replies to the question regarding extent of discouragement from having more children because of poor health of children, these data are of limited use for fertility comparisons. The fertility rates among "planned families" by wife's statement of extent of discouragement are as follows: "very much or much," 160; "some," 189; "little," 186; and "very little or not at all," 189. These rates are based upon 20, 27, 29, and 402 cases respectively.

In summary, although more adequate measures of health of wife, husband, and children are needed for rigorous testing, the data that are available from the Indianapolis Study fail to confirm the hypotheses that the poorer the health of wife, husband, and children the higher is the proportion of couples practicing contraception effectively and the smaller are the planned families. In most cases the opposite type of relationship is found. To some extent the relationship observed between health and fertility-planning status can be accounted for by the interrelation of socio-economic status, health, and fertility-planning status.

As with other factors investigated in the Study, there probably is a two-way relation between fertility and health. Probably some of the planned families in the Study have regulated family size partly on the basis of health of wife or children. It seems almost certain that, especially in the "excess fertility" group, poor health of wives and children is in part a function of high fertility and poverty.

Appendix I

Number of couples by fertility-planning status and ratings of self, spouse, and interviewer on pep and energy of wife and husband.

Rating on Pep and Energy	Pep and Energy of Wife					Pep and Energy of Husband				
	Number of Couples by Fertility-Planning Status									
	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility	Total	Number and Spacing Planned	Number Planned	Quasi-Planned	Excess Fertility
All Couples	1,444	403	205	454	382	1,444	403	205	454	382
Rating By Self										
Very Little or Little	76	18	14	19	25	14	1	1	2	10
Somewhat Less Than Average	126	37	23	36	30	90	31	6	29	24
About Average	750	184	70	271	225	734	183	101	241	209
Somewhat More Than Average	221	78	39	58	46	281	82	41	98	60
Much	140	50	13	41	36	141	49	19	44	29
Very Much	131	36	46	29	20	184	57	37	40	50
Rating By Spouse										
Very Little or Little	44	11	6	15	12	35	6	2	7	20
Somewhat Less Than Average	132	39	23	42	28	75	27	12	21	15
About Average	731	196	96	225	214	764	202	96	244	222
Somewhat More Than Average	271	86	29	88	68	256	86	32	80	58
Much	150	42	24	51	33	178	48	26	64	40
Very Much	116	29	27	33	27	136	34	37	38	27
Rating By Interviewer										
Worn Out	75	6	15	24	30	28	5	2	4	17
Some	289	91	29	81	88	114	28	9	38	39
Average	593	157	68	206	162	656	174	70	213	199
Much	410	123	79	119	89	544	163	103	171	107
Unlimited	77	26	14	24	13	99	33	18	28	20
Unknown						3		3		

ANNOTATIONS

TOMORROW'S HORIZON IN PUBLIC HEALTH[1]

THE Public Health Association of New York City sponsored a one-day program in January, 1950, entitled "Tomorrow's Horizon in Public Health." This meeting brought together specialists from many branches of the public health field to prognosticate the role of public health agencies in an era of increasing state participation in public health and to discuss the broadening scope and interpretations of the "newer epidemiology."

The increasing participation and responsibility of the state in public health work was discussed by two of the speakers. Dr. Smillie[2] traced the state's participation in public health from its very minor role in the early history of this country to its more active role today. He spoke of the increasing responsibility of the state and hopes that it will gradually emerge "with a comprehensive, serviceable, practical program that meets the needs of all people, yet does not violate the basic principles upon which American life and American character are founded." Dr. Galdston[3] spoke of the continuing need for and future role of the voluntary health organizations as their present functions are gradually absorbed by the state. "They should collectively be concerned in and with the development and the application of those knowledges which favor the optimal growth, develop-

[1] Transactions of the 1950 Conference of the Public Health Association of New York City. New York, 1950, 109 pp. Price $1.00. This volume can be obtained from Mr. Charles A. Freck, Secretary-Treasurer, New York City Public Health Association, Queensboro Tuberculosis and Health Association, 59–29 90th Avenue, Jamaica, New York.

[2] W. G. Smillie, M.D., Professor of Public Health and Preventive Medicine, Cornell University Medical College, New York City. N. Y.

[3] Iago Galdston, M.D., President, Public Health Association of New York City.

ment, and function of the individual. They should shift their major concern from disease to well-being."

The "newer epidemiology" was the topic of four papers presented at the meeting. The evolution in the meaning of the term "epidemiology" was discussed; from the simplest definition from the Greek "epi" meaning "among" and "demos" meaning "people" to the more expanded definition of August Hirsh in 1883, "a science which will give firstly a picture of the occurrence, distribution, and types of diseases of mankind in distinct epochs of time at various points on the earth's surface, and secondly will render an account of the relation of these diseases to the external conditions surrounding the individual and determining his manner of life." Each discussant also elaborated this definition from his own experience.

Dr. Gordon[4] in his paper "The Newer Epidemiology" suggested the term "medical ecology" to express the broader concept of epidemiology today. He said, "If the morbid conditions of man are the result of reactions between the human host and his environment, then all mass disease conceivably is to be interpreted in terms of three principal factors, which are host, agent, and environment. Thus regarded, disease and injury, and also the physiologic state, are recognized as ecologic phenomena, and amenable in their group manifestations to the methods of epidemiological analysis. Epidemiology is viewed as a biologic discipline applicable to all diseases where groups of persons and things are involved." Dr. Gordon also emphasized the supplementary roles of clinical medicine and epidemiology in public health today. Each can contribute to the study of the new concept of "multiple causation" of disease and to the identification of the normal state or health.

Dr. Kruse[5] in his paper "Nutrition in the Light of the Newer Epidemiology" discussed the interdependence of epidemiology and the other sciences, particularly biology and medicine. Knowledge of the epidemiology of a disease is arrived at by drawing first from one "discipline or aspect" then another, and thus progress is often interrupted because knowledge in all of

[4] John E. Gordon, M.D., Professor of Preventive Medicine and Epidemiology, Harvard University School of Public Health, Boston, Massachusetts.

[5] H. D. Kruse, M.D., Milbank Memorial Fund.

the component fields does not progress at an even pace. Also, "current vogues in thinking, adherence to tradition or weight of authority, and a natural inertia" resist change and create a lag. Dr. Kruse illustrated these points by tracing the slow development in the knowledge of the etiology of the deficiency diseases. Many epidemiological aspects of the diseases were known but not their causation. Through evidence amassed in animal experiments, it gradually became evident that there was a "category of deficiency diseases which shared a similarity in their pattern of causation." However, the "germ-toxic" concept was so popular at the time that it preoccupied all thinking. By further experimentation, however, it was demonstrated that each deficiency disease could be prevented or corrected by the addition of an essential nutrient or vitamin to the diet. This evidence led to the belief that "poor diet is the one and only cause of the deficiency diseases." However, further study led to the theory of multiple causation of the deficiency diseases. "Economic level, geographic region, and age" were found to be important factors in malnutrition as well as a diet lacking in the essential nutrients.

"Tuberculosis in the Light of the Newer Epidemiology" was discussed by Dr. Perkins.[6] Epidemiology was formerly concerned only with the study of epidemics, but Dr. Perkins suggested that, since epidemics are not clear-cut entities but "merely relatively short-term waves of incidence in excess of normal incidence," the newer epidemiology must also concern itself with normal incidence. He suggested that the study of "mass pathology" concern itself with endemic as well as epidemic incidence of all stages of health from very severe illness through the milder stages of illness to include health itself. He suggested broadening the scope of epidemiology to include noncommunicable diseases as well as health but cautioned that this should be done in addition to and not at the expense of the epidemiological study of the communicable diseases such as tuberculosis. The broader epidemiological view of the multiple causation of tuberculosis was discussed and also the need for studies as to the relative importance of factors such as low economic status in contributing to tuberculosis.

[6] James E. Perkins, M.D., Managing Director, National Tuberculosis Association.

Dr. Felix[7] in his paper "Permutations in Psychiatry and Public Health" stressed the interdependence of the mental health and public health programs as the emphasis on mental health increases. Dr. Osborne's[8] paper on "Public Health and the School" also emphasized the growing realization of the need for the integration of public health and mental health work with special reference to the children in the schools.

Dr. Ginzberg[9] concluded the series with a paper entitled "Public Health and the Public." He stressed the mutual need for guidance—the contributions that the public health workers can make to the public and that the public can make to the public health workers.

Many of the speakers stressed the need for a broader outlook and less parochialism in future public health work. They suggested horizontal integration of effort among the various public health agencies rather than the older isolated vertical approach to the study of a disease. They advocated a broader interpretation of epidemiology and stressed the theory of multiple causation of diseases. All of the papers were forward-looking and gave the impression that, as Dr. Ginzberg summarized, "we can expect to develop not only better health services, but a better society" in the future.

JANE E. COULTER

[7] Robert H. Felix, M.D., Director, National Institute of Mental Health, United States Public Health Service.
[8] Ernest G. Osborne, Ph.D., Professor of Education, Teachers College, Columbia University.
[9] Eli Ginzberg. Ph.D., Associate Professor of Economics, Columbia University.